PROPOSED AUTOMOBILE EMISSION STANDARDS
AN AIR QUALITY ASSESSMENT

Prepared for

Environment Canada

By

Concord Scientific Corporation
Downsview, Ontario

This report has not undergone detailed technical review by the Environmental Protection Service and the content does not necessarily reflect the views and policies of Environment Canada. Mention of trade names or commercial products does not constitute endorsement for use.

This unedited version is undergoing a limited distribution to transfer the information to people working in related studies. This distribution is not intended to signify publication and, if the report is referenced, the author should cite it as an unpublished report of the Branch indicated below.

Any comments concerning its content should be directed to:

Industrial Programs Branch
Environmental Protection Programs Directorate
Environmental Protection Service
Environment Canada
Ottawa, Ontario
K1A 1C8

IP-11
May, 1984

FINAL REPORT

PROPOSED AUTOMOBILE EMISSION STANDARDS: AN AIR QUALITY ASSESSMENT

CSC 110.J290.1WP

Prepared for

ENVIRONMENT CANADA

by

C.S. Davis
S. Alp
S.G. Onlock
R.V. Portelli
N.W. Reid

CONCORD SCIENTIFIC CORPORATION
2 Tippett Road
Downsview, Ontario
M3H 2V2

March 1984

TABLE OF CONTENTS

Page

List of Figures iii
List of Tables x
List of Appendices xi
Executive Summary xxii

1. INTRODUCTION 1.1
    1.1 Scope of work 1.2

2. CITY SELECTION, DATA SOURCES AND AVAILABILITY 2.1
    2.1 Selection Of Cities For Air Quality Analysis And Compilation of Emission Inventories 2.1
        2.1.1 General Comments On Table 2.1 .... 2.5
        2.1.2 Data Availability in Ten Canadian Cities 2.6
        2.1.3 Air Quality Data 2.7
    2.2 Data Sources and Data Availability 2.15
        2.2.1 Data Sources: Toronto 2.18
        2.2.2 Data Sources: Montreal 2.19
        2.2.3 Data Sources: Vancouver 2.20
        2.2.4 Data Sources: Edmonton 2.21

3. DATA ANALYSIS 3.1
    3.1 Trend Analysis 3.3
    3.2 Air Quality Trends: Toronto 3.5
        3.2.1 Toronto: Carbon Monoxide 3.5
        3.2.2 Toronto: Nitrogen Dioxide 3.10
        3.2.3 Toronto: Ozone 3.15
        3.2.4 Toronto: Total Hydrocarbons 3.21
        3.2.5 Toronto: Total Suspended Particulates 3.26
    3.3 Air Quality Trends: Montreal 3.31
        3.3.1 Montreal: Carbon Monoxide 3.31
        3.3.2 Montreal: Nitrogen Dioxide 3.33
        3.3.3 Montreal: Ozone 3.42

TABLE OF CONTENTS

Page

3.3.4 Montreal: Total Hydrocarbons 3.47
3.3.5 Montreal: Total Suspended Particulates 3.47
3.4 Air Quality Trends: Vancouver 3.53
3.4.1 Vancouver: Carbon Monoxide 3.53
3.4.2 Vancouver: Nitrogen Dioxide 3.58
3.4.3 Vancouver: Ozone 3.63
3.4.4 Vancouver: Total Hydrocarbons 3.68
3.4.5 Vancouver: Total Suspended Particulates 3.69
3.5 Air Quality Trends: Edmonton 3.74
3.5.1 Edmonton: Carbon Monoxide 3.74
3.5.2 Edmonton: Nitrogen Dioxide 3.79
3.5.3 Edmonton: Ozone 3.84
3.5.4 Edmonton: Total Hydrocarbons 3.89
3.5.5 Edmonton: Total Suspended Particulates 3.94
3.6 Summary of Air Quality Trends 3.99

4. EMISSIONS INVENTORY 4.1
4.1 Projection of Emission Inventories 4.8

5. EMISSIONS IN FUTURE YEARS AND THEIR IMPACT ON AIR QUALITY ... 5.1
5.1 Edmonton 5.2
5.2 Montreal 5.5
5.3 Toronto 5.7
5.4 Vancouver 5.9
5.5 Summary 5.11

6. BIBLIOGRAPHY 6.1

Appendices (Volume II)

LIST OF FIGURES

Page

3.1 Key to Box Plots for the Frequency Distribution of 24 hour Average Pollutant Concentrations 3.4

3.2a Toronto Stations: Composite Annual Means of the hourly CO Concentrations 3.6

3.2b Toronto; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations 3.7

3.2c Toronto; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations 3.8

3.2d Toronto; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations 3.9

3.3a Toronto Stations: Composite Annual Means of the hourly NO_2 Concentrations 3.11

3.3b Toronto; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations 3.12

3.3c Toronto; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations 3.13

3.3d Toronto; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations 3.14

3.4a Toronto Stations: Composite Annual Means of the hourly O_3 Concentrations 3.16

3.4b Toronto; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations 3.18

3.4c Toronto; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations 3.19

LIST OF FIGURES

Page

3.4d Toronto; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations 3.20

3.5a Toronto Stations: Composite Annual Means of the hourly THC Concentrations 3.22

3.5b Toronto; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average THC Concentrations 3.23

3.5c Toronto; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average THC Concentrations 3.24

3.5d Toronto; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average THC Concentrations 3.25

3.6a Toronto Stations: Composite Annual Means of the 24 hour Average TSP Concentrations 3.27

3.6b Toronto; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations 3.28

3.6c Toronto; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations 3.29

3.6d Toronto; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations 3.30

3.7a Montreal Stations: Composite Annual Means of the hourly CO Concentrations 3.32

3.7b Montreal; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations 3.34

3.7c Montreal; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations 3.35

LIST OF FIGURES

Page

3.7d Montreal; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations 3.36

3.8a Montreal Stations: Composite Annual Means of the hourly NO_2 Concentrations 3.38

3.8b Montreal; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations 3.39

3.8c Montreal; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations 3.40

3.8d Montreal; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations 3.41

3.9a Montreal Stations: Composite Annual Means of the hourly O_3 Concentrations 3.43

3.9b Montreal; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations 3.44

3.9c Montreal; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations 3.45

3.9d Montreal; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations 3.46

3.10a Montreal Stations: Composite Annual Means of the 24 hour Average TSP Concentrations 3.49

3.10b Montreal; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations 3.50

3.10c Montreal; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations 3.51

LIST OF FIGURES

Page

3.10d Montreal; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations 3.52

3.11a Vancouver Stations: Composite Annual Means of the hourly CO Concentrations 3.54

3.11b Vancouver; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations 3.55

3.11c Vancouver; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations 3.56

3.11d Vancouver; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations 3.57

3.12a Vancouver Stations: Composite Annual Means of the hourly NO_2 Concentrations 3.59

3.12b Vancouver; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations 3.60

3.12c Vancouver; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations 3.61

3.12d Vancouver; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations 3.62

3.13a Vancouver Stations: Composite Annual Means of the hourly O_3 Concentrations 3.64

3.13b Vancouver; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations 3.65

3.13c Vancouver; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations 3.66

LIST OF FIGURES

Page

3.13d Vancouver; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations 3.67

3.14a Vancouver Stations: Composite Annual Means of the 24 hour Average TSP Concentrations 3.70

3.14b Vancouver; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations 3.71

3.14c Vanocuver; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations 3.72

3.14d Vancouver; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations 3.73

3.15a Edmonton Stations: Composite Annual Means of the hourly CO Concentrations 3.75

3.15b Edmonton; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations 3.76

3.15c Edmonton; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations 3.77

3.15d Edmonton; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations 3.78

3.16a Edmonton Stations: Composite Annual Means of the hourly NO_2 Concentrations 3.80

3.16b Edmonton; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations 3.81

3.16c Edmonton; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations 3.82

LIST OF FIGURES

Page

3.16d Edmonton; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations 3.83

3.17a Edmonton Stations: Composite Annual Means of the hourly O_3 Concentrations 3.85

3.17b Edmonton; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations 3.86

3.17c Edmonton; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations 3.87

3.17d Edmonton; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations 3.88

3.18a Edmonton Stations: Composite Annual Means of the hourly THC Concentrations 3.90

3.18b Edmonton; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average THC Concentrations 3.91

3.18c Edmonton; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average THC Concentrations 3.92

3.18d Edmonton; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average THC Concentrations 3.93

3.19a Edmonton Stations: Composite Annual Means of the 24 hour Average TSP Concentrations 3.95

3.19b Edmonton; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations 3.96

3.19c Edmonton; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations 3.97

LIST OF FIGURES

Page

3.19d Edmonton; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations 3.98

4.1 Emission Inventory Trends, 1974-2000: Edmonton 4.10

4.2 Emission Inventory Trends, 1974-2000: Montreal 4.11

4.3 Emission Inventory Trends, 1974-2000: Toronto 4.12

4.4 Emission Inventory Trends, 1974-2000: Vancouver 4.13

LIST OF TABLES

Page

2.1 Population, Motive Fuel and Motor Vehicle Statistics 2.3

2.2 National Air Quality Objectives 2.9

2.3 Selected Ambient Carbon Monoxide Concentration Statistics for Canadian Cities in 1981.... 2.10

2.4 Selected Ambient Nitrogen Dioxide Concentration Statistics for Canadian Cities in 1981 .... 2.11

2.5 Selected Ambient Ozone Concentration Statistics for Canadian Cities in 1981 .... 2.12

2.6 Selected Ambient TSP Concentration Statistics for Canadian Cities in 1981 .... 2.13

3.1 Linear Regression Parameters for Composite Annual Mean Pollutant Concentrations for Various Groupings of Stations in Toronto, Montreal Vancouver and Edmonton.... 3.101

4.1 Emission Inventory: Toronto 4.2

4.2 Emission Inventory: Montreal 4.2

4.3 Emission Inventory: Vancouver 4.3

4.4 Emission Inventory: Edmonton 4.3

4.5 Breakdown of VOC Emissions by Chemical Class: Toronto 4.4

4.6 Breakdown of VOC Emissions by Chemical Class: Montreal 4.5

4.7 Breakdown of VOC Emissions by Chemical Class: Vancouver 4.6

4.8 Breakdown of VOC Emissions by Chemical Class: Edmonton 4.7

4.9 Projected Vehicle Emission Factors 4.15

5.1 LDV Contribution to Total Emissions: Edmonton 5.3

5.2 LDV Contribution to Total Emissions: Montreal 5.6

5.3 LDV Contribution to Total Emissions: Toronto 5.8

5.4 LDV Contribution to Total Emissions: Vancouver 5.10

LIST OF APPENDICES

A Air Quality Data Availability and Site Summaries

A1.1 Availability of Air Quality Data for CO, NO_2, O_3, THC and TSP in Toronto

A1.2 Availability of Air Quality Data for CO, NO_2, O_3 and TSP in Montreal

A1.3 Availability of Air Quality Data for CO, NO_2, O_3, THC and TSP in Vancouver

A1.4 Availability of Air Quality Data for CO, NO_2, O_3, THC and TSP in Edmonton

A2.1 Site Summaries for Toronto Monitoring Stations

A2.2 Site Summaries for Montreal Monitoring Stations

A2.3 Site Summaries for Vancouver Monitoring Stations

A2.4 Site Summaries for Edmonton Monitoring Stations

B Tabulations of Data for Toronto

B1.1 Summary of Monthly and Annual Mean Concentrations for CO

B1.2 Percentile Distribution of CO Concentrations

B1.3 Summary of Exceedances of National Air Quality Objectives for CO

LIST OF APPENDICES (Cont'd)

B2.1 Summary of Monthly and Annual Mean Concentrations for NO_2

B2.2 Percentile Distribuion of NO_2 Concentrations

B2.3 Summary of Exceedances of National Air Quality Objectives for NO_2

B3.1 Summary of Monthly and Annual Mean Concentrations for O_3

B3.2 Percentile Distribution of O_3 Concentrations

B3.3 Summary of Exceedances of National Air Quality Objectives for O_3

B4.1 Summary of Monthly and Annual Mean Concentrations for THC

B4.2 Percentile Distribution of THC Concentrations

B4.3 Number of Stations, Data Recovery and Maximum Daily and Hourly Mean THC Concentrations

B5.1 Summary of Monthly and Annual Mean Concentrations for TSP

B5.2 Percentile Distribution of TSP Concentrations

B5.3 Summary of Exceedances of National Air Quality Objectives for TSP

LIST OF APPENDICES (Cont'd)

C Tabulations of Data for Montreal

C1.1 Summary of Monthly and Annual Mean Concentrations for CO

C1.2 Percentile Distribution of CO Concentrations

C1.3 Summary of Exceedances of National Air Quality Objectives for CO

C2.1 Summary of Monthly and Annual Mean Concentrations for NO_2

C2.2 Percentile Distribution of NO_2 Concentrations

C2.3 Summary of Exceedances of National Air Quality Objectives for NO_2

C3.1 Summary of Monthly and Annual Mean Concentrations for O_3

C3.2 Percentile Distribution of O_3 Concentrations

C3.3 Summary of Exceedances of National Air Quality Objectives for O_3

C4.1 Summary of Monthly and Annual Mean Concentrations for TSP

C4.2 Percentile Distribution of TSP Concentrations

C4.3 Summary of Exceedances of National Air Quality Objectives for TSP

LIST OF APPENDICES (Cont'd)

D Tabulations of Data for Vancouver

D1.1 Summary of Monthly and Annual Mean Concentrations for CO

D1.2 Percentile Distribution of CO Concentrations

D1.3 Summary of Exceedances of National Air Quality Objectives for CO

D2.1 Summary of Monthly and Annual Mean Concentrations for NO_2

D2.2 Percentile Distribution of NO_2 Concentrations

D2.3 Summary of Exceedances of National Air Quality Objectives for NO_2

D3.1 Summary of Monthly and Annual Mean Concentrations for O_3

D3.2 Percentile Distribution of O_3 Concentrations

D3.3 Summary of Exceedances of National Air Quality Objectives for O_3

D4.1 Summary of Monthly and Annual Mean Concentrations for TSP

D4.2 Percentile Distribution of TSP Concentrations

D4.3 Summary of Exceedances of National Air Quality Objectives for TSP

LIST OF APPENDICES (Cont'd)

E Tabulations of Data for Edmonton

E1.1 Summary of Monthly and Annual Mean Concentrations for CO

E1.2 Percentile Distribution of CO Concentrations

E1.3 Summary of Exceedances of National Air Quality Objectives for CO

E2.1 Summary of Monthly and Annual Mean Concentrations for NO_2

E2.2 Percentile Distribution of NO_2 Concentrations

E2.3 Summary of Exceedances of National Air Quality Objectives for NO_2

E3.1 Summary of Monthly and Annual Mean Concentrations for O_3

E3.2 Percentile Distribution of O_3 Concentrations

E3.3 Summary of Exceedances of National Air Quality Objectives for O_3

LIST OF APPENDICES (Cont'd)

E4.1 Summary of Monthly and Annual Mean Concentrations for THC

E4.2 Percentile Distribution of THC Concentrations

E4.3 Number of Stations, Data Recovery and Maximum Daily and Hourly Mean THC Concentrations

E5.1 Summary of Monthly and Annual Mean Concentrations for TSP

E5.2 Percentile Distribution of TSP Concentrations

E5.3 Summary of Exceedances of National Air Quality Objectives for TSP

F Plots of Composite Monthly Means: Toronto

F1.1 Composite Monthly Mean CO Concentrations for All Stations

F1.2 Composite Montly Mean CO Concentrations for Residential Station

F1.3 Composite Monthly Mean CO Concentrations for Nonresidential Stations

F2.1 Composite Monthly Mean NO_2 Concentrations for All Stations

LIST OF APPENDICES (Cont'd)

F2.2 Composite Monthly Mean NO_2 Concentrations for Residential Station

F2.3 Composite Monthly Mean NO_2 Concentrations for Nonresidential Stations

F3.1 Composite Monthly Mean O_3 Concentrations for All Stations

F3.2 Composite Monthly Mean O_3 Concentrations for Residential Station

F3.3 Composite Monthly Mean O_3 Concentrations for Nonresidential Stations

F4.1 Composite Monthly Mean THC Concentrations for All Stations

F4.2 Composite Monthly Mean THC Concentrations for Residential Station

F4.3 Composite Monthly Mean THC Concentrations for Nonresidential Stations

F5.1 Composite Monthly Mean TSP Concentrations for All Stations

F5.2 Composite Monthly Mean TSP Concentrations for Residential Station

F5.3 Composite Monthly Mean TSP Concentrations for Nonresidential Stations

LIST OF APPENDICES (Cont'd)

G Plots of Composite Monthly Means: Montreal

G1.1 Composite Monthly Mean CO Concentrations for All Stations

G1.2 Composite Monthly Mean CO Concentrations for Residential Stations

G1.3 Composite Monthly Mean CO Concentrations for Nonresidential Stations

G2.1 Composite Monthly Mean NO_2 Concentrations for All Stations

G2.2 Composite Monthly Mean NO_2 Concentrations for Residential Stations

G2.3 Composite Monthly Mean NO_2 Concentrations for Nonresidential Stations

G3.1 Composite Monthly Mean O_3 Concentrations for All Stations

G3.2 Composite Monthly Mean O_3 Concentrations for Residential Stations

G3.3 Composite Monthly Mean O_3 Concentrations for Nonresidential Stations

LIST OF APPENDICES (Cont'd)

G4.1 Composite Monthly Mean TSP Concentrations for All Stations

G4.2 Composite Monthly Mean TSP Concentrations for Residential Stations

G4.3 Composite Monthly Mean TSP Concentrations for Nonresidential Stations

H Plots of Composite Monthly Means: Vancouver

H1.1 Composite Monthly Mean CO Concentrations for All Stations

H1.2 Composite Monthly Mean CO Concentrations for Residential Stations

H1.3 Composite Monthly Mean CO Concentrations for Nonresidential Stations

H2.1 Composite Monthly Mean NO_2 Concentrations for All Stations

H2.2 Composite Monthly Mean NO_2 Concentrations for Residential Stations

H2.3 Composite Monthly Mean NO_2 Concentrations for Nonresidential Stations

LIST OF APPENDICES (Cont'd)

H3.1 Composite Monthly Mean O_3 Concentrations for All Stations

H3.2 Composite Monthly Mean O_3 Concentrations for Residential Stations

H3.3 Composite Monthly Mean O_3 Concentrations for Nonresidential Stations

H4.1 Composite Monthly Mean TSP Concentrations for All Stations

H4.2 Composite Monthly Mean TSP Concentrations for Residential Stations

H4.3 Composite Monthly Mean TSP Concentrations for Nonresidential Stations

I Plots of Composite Monthly Means: Edmonton

I1.1 Composite Monthly Mean CO Concentrations for All Stations

I1.2 Composite Monthly Mean CO Concentrations for Residential Stations

I1.3 Composite Monthly Mean CO Concentrations for Nonresidential Stations

I2.1 Composite Monthly Mean NO_2 Concentrations for All Stations

LIST OF APPENDICES (Cont'd)

I2.2 Composite Monthly Mean NO_2 Concentrations for Residential Stations

I2.3 Composite Monthly Mean NO_2 Concentrations for Nonresidential Stations

I3.1 Composite Monthly Mean O_3 Concentrations for All Stations

I3.2 Composite Monthly Mean O_3 Concentrations for Residential Stations

I3.3 Composite Monthly Mean O_3 Concentrations for Nonresidential Stations

I4.1 Composite Monthly Mean THC Concentrations for All Stations

I4.2 Composite Monthly Mean THC Concentrations for Residential Stations

I4.3 Composite Monthly Mean THC Concentrations for Nonresidential Stations

I5.1 Composite Monthly Mean TSP Concentrations for All Stations

I5.2 Composite Monthly Mean TSP Concentrations for Residential Stations

I5.3 Composite Monthly Mean TSP Concentrations for Nonresidential Stations

LIST OF APPENDICES (Cont'd)

J Mathematical Formulae

EXECUTIVE SUMMARY

Proposed changes in Canadian automotive emission standards have the potential for altering ambient air quality levels. An assessment of the likely impact of those proposed changes on Canadian urban air quality was carried out. The mandates for this assessment were to examine historical air quality data in selected urban areas to establish trends in air quality levels for the pollutants CO, NO_2, O_3, THC and TSP, to compile emission inventories for carbon monoxide, nitrogen oxides and volatile organic compounds in the selected urban areas and to prepare projections of automotive emissions for each year up to the year 2000 based on various source growth scenarios and specified emission factors. Based on these analyses, the likely future trends in air quality in the selected urban areas are discussed.

City Selection

The cities selected for study were Toronto, Montreal, Vancouver and Edmonton. The selection was made after consideration of the fraction of the Canadian population in each of ten Canadian cities, the fraction of retail Canadian gasoline sales and the Canadian automobile fleet in each city, geographic location, the availability of historical air quality data (for CO, NO_2, O_3, THC and TSP) and emissions inventory data and also on an analysis of air quality in 1981.

The four cities selected account for 31.7 % of the Canadian population, 22.6 % and 18.2 % respectively of gasoline and diesel fuel sales, and represent wide geographical coverage. The four cities also have the largest amount of relevant historical air quality data.

Data Availability

For the analysis of historical trends in air quality, data were obtained from the following sources:

i) National Air Pollution Surveillance (NAPS) Network,
ii) Ontario Ministry of the Environment,
iii) Alberta Ministry of the Environment,
iv) Archives of oxidant related air quality data for Montreal and Vancouver.

The data from the first three sources were screened to ensure the exclusion of invalid data. The oxidant archives included data originally obtained from the Greater Vancouver Regional District, the NAPS data base, and the Montreal Urban Community. These data were previously screened to exclude invalid data prior to archiving.

Air quality data for TSP were available since 1970 in Toronto, Vancouver and Edmonton and since 1971 in Montreal. Carbon monoxide data were available in Toronto, Montreal, Vancouver and Edmonton since 1970, 1971, 1975 and 1976 respectively. Data for both O_3 and NO_2 were available in Toronto since 1974, Vancouver since 1978 and Montreal since 1979. In Edmonton, O_3 data were available since 1978 and NO_2 data since 1975. Adequate THC data were available only in Toronto (since 1971) and Edmonton (since 1974).

The stations in each city were classified into residential or non-residential stations based on the examination of site documentation for the NAPS network or information supplied by appropriate municipal or provincial sources.

Air Quality: Trends

The hourly (or 24 hourly in the case of TSP) data were used to generate the following statistics for each of the residential and non-residential station groupings in each city as well as for all stations in each city:

- composite monthly and annual means,
- exceedances of air quality objectives,
- daily mean concentrations corresponding to various percentiles of the distribution of daily means on an annual basis.

The data were presented graphically using three types of plots for each of the three groupings of stations, namely:

- composite annual means for each pollutant in each city,
- box plots to illustrate the annual distributions of the daily means for each pollutant by city,
- composite monthly means for each pollutant by city.

The first two types of plots are provided within the text. These plots include an indication of the numbers of stations in each grouping for each year. The plots showing the composite monthly means are provided in appendices (Volume II).

The examination of the plots and the tabulated data allowed the determination of overall trends for each pollutant, the longer term (monthly to annual) cyclical trends in pollutant concentrations, overall trends in air quality on a citywide basis and also allowed comparisons between residential and non-residential stations.

Overall Trends by Pollutant

Total Suspended Particulates

The overall trends in TSP levels were to lower TSP levels in Toronto, Montreal and Vancouver but to higher TSP levels in Edmonton.

The TSP levels were generally lower in the cooler months - especially in Edmonton.

In Vancouver in the last eight years, close to 10 % of the 24 hour average TSP levels exceeded the maximum acceptable 24 hour average air quality objective level for TSP, while in Edmonton, close to 25% of the TSP data exceeded that air quality objective. In Toronto and Montreal, between 10 and 25 % of the TSP data exceeded the maximum acceptable air quality objective level for TSP averaged over 24 hours.

Carbon Monoxide

There were no significant trends in CO levels in any city. Toronto had the most consistent trend - that to lower CO levels with an overall average decrease of about 0.2 ppm/year due to large decreases in CO levels between 1974 and 1976. The CO levels in Toronto, Montreal and Vancouver were similar between 1976 and 1981 but there were slightly higher levels in Montreal during those years.

Nitrogen Dioxide

There were overall decreases in NO_2 levels in Montreal, Toronto and Edmonton but the levels in Vancouver showed an overall increase. NO_2 levels were generally highest in Edmonton with composite annual means (all stations) in the range of 30 - 40 ppb and lowest in Vancouver (composite annual means for all stations 20 - 24 ppb). The NO_2 levels were higher in the colder months in Edmonton (especially) and Montreal but different patterns were shown in Vancouver and Toronto.

Ozone

The most striking feature of the ozone data is the well defined pattern in which highest ozone levels occurred between May and July and lowest levels in October through December each year. This pattern is consistent with the monthly variation of solar intensity and the photochemical basis for ozone formation.

There were little differences in the composite annual mean ozone levels (for all stations) in the four cities. However, the maximum acceptable air quality objective level of 82 ppb averaged over one hour was exceeded regularly in all cities. The maximum acceptable ozone air quality objective level for a 24 hour average (25 ppb), was exceeded on at least 10 % of all days in each city in nearly every year.

The maximum tolerable air quality objective level for ozone for a one hour averaging period (153 ppb), was exceeded in Toronto (once in each of the years 1974, 1975 and 1979), Vancouver (a total of 88 times between 1978 and 1981) and Edmonton (once in 1979).

Total Hydrocarbons

THC data in Toronto and Edmonton were analysed but there were no discernible upward or downward trends. THC levels were higher and more variable in Edmonton than in Toronto and showed no cyclical pattern.

Overall Trends by City

The most consistent trend in any city was one of improved air quality in Toronto where nearly all pollutants regardless of station grouping had negative slopes in the regression of composite annual mean pollutant level versus time. In the other three cities, there were mixed trends depending on the pollutant. In Montreal and Vancouver, NO_2 and TSP levels tended to decrease for all groupings of stations, while in Edmonton, only TSP showed a consistent trend namely that to higher levels for all groupings of stations.

The air quality levels at the residential stations were generally lower than those at the non-residential stations. The notable exception was in the case of ozone where there were lower levels at the non-residential stations, a factor most likely due to the depletion of ozone by nitric oxide at the non-residential stations.

Emission Inventories

Emission inventory data were tabulated for the four study cities. Species included in the emission inventories were CO, NO_x and volatile organic compounds (VOC). A breakdown of the VOC emissions by chemical class was also provided. The relative importance of light duty vehicle (LDV) emissions depends both on the species involved and the city. In 1978, the fractional contribution of LDV emissions to the total is as given below.

Species	City			
	Edmonton	Montreal	Toronto	Vancouver
CO	0.48	0.67	0.68	0.58
NO_x	0.18	0.28	0.27	0.34
VOC	0.27	0.27	0.40	0.38

Future trends

A very simple projection of expected emissions for the years 1980 to 2000 was carried out. Four growth rate scenarios (0.5, 1.0, 1.5, and 2.0 per cent per year) were applied uniformly to light duty vehicle usage and the emissions from all other source sectors. The motor vehicle (LDV) usage was combined with the appropriate emission factors expected for future years. These emission factors are expected to decline between the present and 1990, as older vehicles not meeting these standards are phased out, and will remain constant thereafter (assuming that current emission standards are maintained). The effect is that total emissions in many cases decrease until about 1990, rising thereafter.

The relative magnitudes of the decrease and subsequent increase in emissions vary from city to city. Qualitatively, it is expected that increases in ambient concentrations of the following species may occur over about the next decade:

Edmonton: NO_x, THC
Montreal: NO_x, THC, O_3
Toronto: NO_x
Vancouver: THC, O_3

Although the fractional contribution of LDV emissions to the total for any given pollutant is expected to decline, this contribution will remain significant. This is particularly true in the case of VOCs, where the high reactivity of automobile emissions enhances their impact.

RÉSUMÉ

LES NORMES PROPOSÉES LIMITANT LES ÉMISSIONS DES VÉHICULES À MOTEUR ET LEURS INCIDENCES SUR LA QUALITÉ DE L'AIR*

Concord Scientific Corporation
Downsview (Ontario)

Les modifications proposées aux normes canadiennes limitant les émissions des véhicules à moteur peuvent diminuer les teneurs en polluants dans l'air. Une analyse des incidences possibles des normes proposées sur la qualité de l'air en milieu urbain a été effectuée. Dans le cadre de cette analyse on a fait une étude statistique de la qualité de l'air dans des régions urbaines choisies afin de déterminer l'évolution des différentes teneurs en monoxyde de carbone (CO), en dioxyde d'azote (NO_2), en ozone (O_3), en hydrocarbures totaux (HT) et en particules totales en suspension (PTS). On a aussi dressé l'inventaire des émissions de monoxyde de carbone, d'oxydes d'azote et de composés organiques volatils et établi des prévisions annuelles des émissions des véhicules à moteur jusqu'à l'an 2000 à l'aide de facteurs d'émission spécifiques et en tenant compte de divers scénarios de croissance des sources. Cette analyse permettra de brosser un tableau de l'évolution de la qualité de l'air dans les régions urbaines choisies.

Choix des villes

Toronto, Montréal, Vancouver et Edmonton ont été choisies parmi six autres villes canadiennes. Le choix a été fondé sur l'importance de la population, des ventes au détail de l'essence et du parc automobile, de chaque ville ainsi que sur la situation géographique et l'aspect démographique national. On a aussi tenu compte des données disponibles sur la qualité de l'air (CO, NO_2, O_3, HT, et PTS) de l'inventaire des émissions de polluants et d'une étude de la qualité de l'air effectuée en 1981.

Les populations réunies des quatre villes choisies représentent 31,7 p. 100 de la population canadienne, les ventes d'essence et de carburant diesel, comptent pour 22,6 p. 100 et 18,2 p. 100 respectivement du total national. Les villes sont bien réparties du point de vue géographique et l'on y trouve le plus grand nombre de données pertinentes sur la qualité de l'air.

---

* MAS, contrat n° KE145-3-0031, mars 1984.

Données disponibles

Les données qui ont servi à l'étude des tendances de la qualité de l'air ont été obtenues des sources suivantes:

- Réseau national de surveillance de la pollution atmosphérique (NSPA), d'Environnement Canada
- Ministère de l'Environnement de l'Ontario
- Ministère de l'Environnement de l'Alberta
- Archives de données atmosphériques relatives aux oxydants, tenues à Montréal et à Vancouver

Les données provenant des trois premières sources ont été soumises à un procédé de sélection pour éliminer celles qui étaient aberrantes. Les archives portant sur les oxydants comprennent des données obtenues initialement du district régional du Grand Vancouver, de la base de données du réseau NSPA et de la communauté urbaine de Montréal; les données aberrantes y avaient déjà été éliminées.

Les données suivantes ont été mises à notre disposition: 1) teneurs en particules totales en suspension à partir de 1970 pour Toronto, Vancouver et Edmonton et de 1971 pour Montréal; 2) teneurs en monoxyde de carbone (CO) à partir de 1970, 1971, 1975 et 1976 pour Toronto, Edmonton, Vancouver et Montréal, respectivement; 3) teneurs en ozone (O_3) et en dioxyde d'azote (NO_2) à partir de 1974 pour Toronto, de 1978 pour Vancouver, de 1979 pour Montréal, et de 1978 dans le cas de l'ozone et de 1975 dans le cas du dioxyde d'azote pour Edmonton. En ce qui concerne les HT, des données valables ont été obtenues seulement pour Toronto (à partir de 1971) et Edmonton (à partir de 1974).

Les stations d'échantillonnage de chaque ville ont été classées par secteurs résidentiels et non résidentiels d'après la description de leur emplacement établie pour le réseau NSPA ou d'après les renseignements fournis par les autorités municipales ou provinciales compétentes.

Évolution de la qualité de l'air

Les données horaires ou journalières (24 h) dans le cas des PTS, ont été utilisées pour le calcul des valeurs ci-dessous qui représentent les groupes de stations des secteurs résidentiels et non résidentiels ainsi que l'ensemble des stations de chaque ville:

- Moyennes mensuelles et annuelles composées
- Épisodes de dépassement des teneurs maximales fixées comme objectifs de qualité de l'air

- Teneurs moyennes quotidiennes correspondant à divers percentiles de la distribution des moyennes quotidiennes sur une base annuelle.

Les données pour chaque polluant et chaque ville sont présentées dans les trois graphiques suivants pour chacun des trois groupes de stations:

- Moyennes annuelles composées
- Distribution annuelle des moyennes quotidiennes
- Moyennes mensuelles composées

L'examen des graphiques et des tableaux de données a permis d'établir l'évolution générale de chaque polluant, les tendances cycliques à plus long terme (à une échelle mensuelle ou annuelle) de la teneur en polluants, l'évolution générale de la qualité de l'air dans chaque ville ainsi que des comparaisons entre les stations des secteurs résidentiels et non résidentiels.

Particules totales en suspension. L'évolution générale se traduit par une diminution à Toronto, Montréal et Vancouver, et une augmentation à Edmonton. Les teneurs ont été généralement moins élevées les mois où le temps est plus frais, particulièrement à Edmonton.

À Vancouver, au cours des huit dernières années, près de 10 p. 100 des moyennes de 24 h pour les PTS ont dépassé la moyenne maximale acceptable de 24 h fixée comme objectif de qualité de l'air pour ce paramètre, comparativement à près de 25 p. 100 à Edmonton. À Toronto et Montréal, la concentration maximale a été dépassée dans 10 et 25 p. 100 des cas respectivement.

Monoxyde de carbone. On n'a constaté nulle part aucune évolution importante. À Toronto cependant, on a noté une tendance à la baisse des teneurs moyennes en CO d'environ 0,2 ppm par année, en raison d'une forte réduction des teneurs entre 1974 et 1976. De 1976 à 1981, les teneurs en CO ont été similaires à Toronto, Montréal et Vancouver, mais un peu plus élevées à Edmonton.

Dioxyde d'azote. Dans l'ensemble, les teneurs ont diminué à Montréal, Toronto et Edmonton, mais ont augmenté à Vancouver. Généralement, elles ont été plus élevées à Edmonton et plus faibles à Vancouver: les moyennes annuelles composées (toutes les stations) y ont varié respectivement entre 30 et 40 ppb (10^{-9}) et entre 20 et 24 ppb. Les teneurs en NO_2 ont été plus élevées pendant les mois de temps froid à Edmonton (surtout) et à Montréal.

Ozone. Les données ont surtout permis de constater des épisodes bien précis de teneurs plus élevées entre mai et juillet, et plus faibles entre octobre et décembre de chaque année. Ces épisodes correspondent aux variations mensuelles de l'intensité du rayonnement solaire et s'expliquent par la théorie photochimique de la formation de l'ozone.

Les moyennes annuelles composées (données de toutes les stations) varient un peu entre les villes. Cependant, dans les quatre, la moyenne maximale acceptable fixée comme objectif de qualité de l'air, soit 82 ppb (10^{-9}) pour une période d'une heure, a été régulièrement dépassée. La moyenne acceptable pour une période de 24 h, soit 25 ppb, a également été dépassée presque chaque année au moins un jour sur dix aux quatre endroits.

La moyenne maximale tolérable pour une période d'une heure, soit 153 ppb, a été dépassée à Toronto (une fois l'an en 1974, 1975 et 1979), à Vancouver (88 fois au total de 1978 à 1981) et à Edmonton (une fois en 1979).

Hydrocarbures totaux. Les données pour Toronto et Edmonton ont été analysées, mais on n'a pu constater aucune tendance à la hausse ou à la baisse. À Edmonton, les concentrations ont été plus élevées et plus variables qu'à Toronto, mais aucun phénomène cyclique n'a été observé.

Évolution générale des polluants dans chaque ville

L'évolution la plus régulière a été constatée à Toronto où la qualité de l'air s'est améliorée, et pour presque tous les polluants, quel que soit le groupe de stations, la pente de la courbe de régression de la moyenne annuelle composée en fonction du temps est négative. Dans les trois autres villes, l'évolution varie selon les polluants. À Montréal et à Vancouver, pour tous les groupes de stations, les teneurs en NO_2 et en PTS sont à la baisse tandis qu'à Edmonton, elles sont à la hausse seulement dans le cas des PTS (pour tous les groupes de stations).

Aux stations des secteurs résidentiels, la qualité de l'air a été généralement moins bonne qu'aux stations des secteurs non résidentiels, sauf, fait à remarquer, pour l'ozone, dont la concentration a été plus faible aux stations des secteurs non résidentiels, fort probablement à cause de l'action de l'oxyde nitrique.

Inventaires d'émissions

Les inventaires d'émissions ont permis de produire des tableaux des émissions de CO, de NO_x et de composés organiques volatils (COV) dans les quatre villes. Ils fournissent également des données sur les COV par classe de composés chimiques.

L'importance relative des émissions provenant des véhicules légers dépend à la fois du composé et de la ville. Le tableau suivant indique, pour 1978, la fraction des émissions totales qui ont été produites par les véhicules légers.

Composés	Edmonton	Montréal	Toronto	Vancouver
CO	0,48	0,67	0,68	0,58
NO_x	0,18	0,28	0,27	0,34
COV	0,27	0,27	0,40	0,38

Évolution future

On a fait une très simple projection des émissions prévues pour la période s'étendant de 1980 à l'an 2000. Quatre taux d'augmentation (0,5, 1,0, 1,5 et 2,0 p. 100 par année) ont été appliqués uniformément à l'utilisation des véhicules légers et aux émissions provenant de tous les autres secteurs. On a également tenu compte, avec les taux d'augmentation de l'utilisation des véhicules légers, des facteurs d'émission appropriés prévus pour les prochaines années. La valeur de ces facteurs devrait diminuer d'ici 1990 avec l'élimination graduelle des véhicules plus anciens ne statisfaisant pas aux normes et devrait demeurer constante par la suite (sous réserve que les normes d'émission actuelles soient maintenues). En conséquence, dans un grand nombre de cas, les émissions totales diminueront jusqu'en 1990 environ, puis augmenteront.

L'ordre de grandeur relatif des diminutions et des augmentations subséquentes des émissions varie pour chaque ville. Au point de vue qualitatif, on prévoit que la concentration des composés suivants dans l'air ambiant augmentera au cours des dix prochaines années environ:

À Edmonton: NO_x, HT

À Montréal: NO_x, HT, O_3

À Toronto: NO_x

À Vancouver: HT, O_3

Bien que l'on s'attende pour chaque polluant à une diminution de la fraction des émissions totales attribuable aux véhicules légers, ces véhicules contribueront encore de façon importante à la pollution de l'atmosphère. C'est particulièrement vrai pour les COV, car la très grande réactivité des émissions provenant des véhicules automobiles accentue leurs effets.

1. INTRODUCTION

The proposed revisions of regulations restricting automotive emissions of nitrogen oxides (NO_x), carbon monoxide (CO) and hydrocarbons (HC) indicated the need to assess the following aspects of the proposed revisions:

a) Adverse effects on human health and materials of automotive air pollutants.
b) Canadian air quality in respect of automotive air pollutants.
c) Technological factors and direct costs of controlling automotive air pollutants in Canada.
d) Economic benefits and aggregate costs of controlling automotive air pollutants in Canada.

Automotive emissions of unburnt hydrocarbons, nitrogen oxides, carbon monoxide and particulates contribute to the ambient air quality levels. In addition, these pollutants are among those directly involved in the formation of secondary pollutants such as acid precipitation and photochemical smog. The most readily available indication of secondary pollutants is ambient ozone concentration data.

The examination of ambient air quality data, together with emissions inventory information (which disaggregate automotive contributions) and a discussion of the likely impact of automotive emissions air quality in selected Canadian cities constitute the work required for this project.

1.1 Scope of work

The objectives of this study are to:

1. Summarize the ambient air quality data relevant to automotive emissions for selected Canadian cities.
2. Prepare time series and graphs that illustrate the changes in air quality in the selected cities.
3. Determine and summarize the contribution of automotive sources to emission inventories.
4. Discuss the impact that emissions in future years will have on air quality in selected cities.

Four cities - Toronto, Montreal, Vancouver and Edmonton - were selected for the detailed analysis of trends in historical air quality levels and for the disaggregation of historical and projected emissions inventory.

The cities were selected after considering factors such as population, relative amounts of automobile emissions (indicated by automotive fuel sales and numbers of vehicles), data availability, the existing air quality, geographic location and meteorology. The basis for the city selection is given in Section 2.

The air quality data used in the analysis was derived primarily from the National Air Pollution Surveillance (NAPS) network and from provincially or municipally operated networks. Details of the data sources and availability are also presented in Section 2. Also indicated in this section are the quality control procedures used to select and screen the data. The stations in each city were classified as residential or nonresidential based on the site documentation for the NAPS network air monitoring stations or on information from appropriate municipal sources.

The data analysis (Section 3) was performed on three groupings of stations (all, residential, nonresidential) and included the generation of composite group means on monthly and annual bases, the tabulation of the numbers of exceedances of various national air quality objectives and also the concentrations of the daily means for various percentiles in annual distributions of the daily means. Discussions of the trends in the data on a city basis as well as for each pollutant are given along with various graphical presentations of the data.

The 1978 emission inventories of carbon monoxide (CO), nitrogen oxides (NO_x) and volatile organic carbon (VOC) for each of the four cities are presented in Section 4. The VOC emissions are disaggregated into four classes of hydrocarbons based on reactivity and a breakdown of the VOC emissions into the various source contributions is given. Summaries of the 1974 and 1976 emission inventories for CO, NO_x and VOC are also presented together with projections of emission inventories up to the year 2000. These projections were prepared using suitable estimates of growth rates of the various source sectors and emission factors for the automobile fleet.

The final section summarizes the trends in the air quality data and indicates the likely impact which changes in emissions - in particular automobile emissions - may have on air quality levels.

Tabulations of the data analysis, plots of composite monthly mean concentrations of the pollutants and mathematical formulae used for the data analysis are provided in Appendices.

2. CITY SELECTION, DATA SOURCES AND AVAILABILITY

2.1 Selection Of Cities For Air Quality Analysis And Compilation of Emission Inventories

Four cities, namely Toronto, Montreal, Vancouver and Edmonton, were selected for air quality and emission inventory analyses. The selection was based on criteria that considered the following aspects:

a) the fraction of the Canadian population in each city,

b) the fraction of retail Canadian gasoline sales in each city,

c) the fraction of the Canadian automobile fleet in each city,

d) geographic location,

e) the availability of emissions inventory data,

f) the availability of historical air quality data,

g) existing air quality.

The nine most populous Canadian cities and Halifax (ranked 13th in population) were selected for examination. The city of Halifax was included to provide coverage of a city in the Maritime Provinces. The cities ranked 10th, 11th and 12th in population (1978 data) were St. Catharines-Niagara, Kitchener and London - all of which are in southern Ontario. Representative cities in southern Ontario already included Toronto, Hamilton and Ottawa therefore, St. Catharines-Niagara, Kitchener and London were not included.

For each city and the total for Canada, the following 1978 statistics were tabulated (see Table 2.1):

- City population
- Gasoline sales
- Diesel oil sales
- Passenger automobiles
- Trucks and buses

All these statistics are expressed in absolute amounts in the appropriate units and as a percentage of the Canadian total.

The year 1978 was selected because the most recent commonly available emissions inventory data are for that year.

TABLE 2.1

POPULATION, MOTIVE FUEL AND MOTOR VEHICLE STATISTICS

City	Population[1]		Gasoline Sales[2]		Diesel Oil Sales[3,4,5]		Passenger Automobiles[6]		Trucks and Buses[6]	
	(000)	%	10^6 litres	%	10^6 litres	%		%		%
1 Toronto	2856.5	12.2	3328	9.02	260[7]	5.42[7]	901237[7]	9.25[7]	117687[7]	4.25[7]
2 Montreal	2823.0	12.0	3028	8.20	531	11.1	845000	8.67	134322	4.85
3 Vancouver	1173.3	5.0	1287	3.49	44	0.92	182918	1.88	36109	1.30
4 Ottawa-Hull	726.4	3.1	784	2.12	49[3a]	1.02[3a]	195922[6a][8]	1.61[8]	22151[6b][8]	0.80[8]
5 Winnipeg	589.1	2.5	698	1.89	45[9]	.94[9]	236777	2.43	40892	1.48
6 Edmonton	581.4	2.5	805	2.18	35[10]	.73[10]	247802[10]	2.54[10]	71682[10]	2.59[10]
7 Quebec	554.5	2.4	610	1.65	106	2.21	169000	1.73	26864	0.97
8 Hamilton	536.3	2.3	594	1.61	59	1.23	155220	1.59	26878	0.97
9 Calgary	504.9	2.1	743	2.01	32	.67	276618	2.84	67200	2.42
10 Halifax	271.2	1.2	295	0.80	37	.77	100917	1.04	26259	0.95
TOTAL	10616.6	45.2	12172	33.0	1198	25.0	3311411	34.0	570044	20.6
Canadian	23493.2	100	36909	100	4800	100	9744994	100	2770798	100

1) Census metropolitan area populations on June 1, 1978 in thousands.

2) Retail gasoline statistics by metropolitan area, for last 2 quarter os 1977 and first two quarters of 1978.

3) Obtained by using the formula: Provincial Diesel Sales x # Trucks and Buses in city/# Trucks and Buses in Province.

3a) Data for Ottawa-Hull obtained by scaling based on Ontario Diesel Sales x Trucks and buses in Ottawa/Trucks and buses in Ontario.

4) On April 1, 1978, the government of Alberta removed the tax on all types of motive fuels purchased in that province except for aviation gasoline and railway diesel oil. Due to this situation, the net sales statistics for gasoline, diesel for the province of Alberta do not apply since road-use taxes on fuel have been abolished.

5) Net sales of diesel oil in 1978 on which tax was paid at road-use rates.

6) Road motor vehicle registrations by place of residence or lay place of issuance of licence, 1978.

6a) 1978 data for Ottawa plus 1977 data for electoral county of Hull.

6b) Data for Ottawa only.

TABLE 2.1 (Cont'd)

POPULATION, MOTIVE FUEL AND MOTOR VEHICLE STATISTICS

7) Data from MUC document, "Air Purification in the Island of Montreal". Passenger automobiles, trucks and buses and diesel oil sales assumed to be 34.5 % of provincial figures (2449668 passenger automobiles, 389340 trucks and buses, and 1541000000 litres diesel oil sales).

8) 1980 figures (1978 data not available from Statistics Canada).

9) This figure represents 1978 sales up to April 1, 1978, prorated for year (i.e., 199,000 x 12/3).

10) Quebec City population/Montreal population is 0.20. Diesel oil sales, passenger automobiles and trucks and buses for Quebec City assumed to be 20 % of Montreal values.

Bibliographic References for Table 1: Population, Motive Fuel and Motor Vehicle Statistics

A) Population figures for all cities obtained from Statistics Canada Catalogue #91-207 (1978).

B) Gasoline sales figures for all cities obtained from Statistics Canada Catalogue # 45-006 (1977, 1978). These figures were obtained by using data for the last two quarters of 1977, and the first 2 quarters of 1978, as data for the last two quarters of 1978 were not published.

C) Diesel oil sales figures
   i) Net sales of diesel oil by province for 1978 were obtained for all provinces from Statistics Canada Catalogue # 53-218.

   ii) Figures for trucks and buses in provinces for all provinces obtained from Statistics Canada Catalogue # 53-219 (1978).

   iii) Figures for trucks and buses in cities were obtained from the following sources.

      a) for Hamilton, Toronto, and Ottawa: Vehicle Population by Regional Municipalities, (1978) Licensing & Control Branch, Ontario Ministry of Transportation and Communications.

      b) for Halifax, Calgary, Edmonton, and Vancouver: Statistics Canada Catalogue # 53-219 (1978).

      c) for Montreal: see footnote #7.

      d) for Winnipeg: Statistics Canada Catalogue # 53-219(1980).

      e) for Quebec City: see footnote # 10.

D) Passenger automobile figures for cities were obtained from the same sources used to obtain figures for trucks and buses. (See reference C iii a-e.)

2.1.1 General Comments On Table 2.1

The ten cities comprise 45.2 % of the Canadian population and account for 33 % and 25 % of Canadian gasoline and diesel fuel sales, respectively.

The four most populous cities account for 32.3 % of the Canadian population, and 22.8 % and 18.5 % of the gasoline and diesel fuel sales respectively. The four cities selected account for 31.7 % of the Canadian population and 22.6 and 18.2 % of gasoline and diesel fuel sales respectively.

Of the cities not included in the four selected, Calgary is the only case where fuel sales or passenger automobiles were higher than in any (Edmonton) of the four cities selected.

The application of the criteria for Canada-wide geographic coverage would not allow both Edmonton and Calgary to be selected. The greater population in Edmonton together with the better air quality data availability (see below) dictated the choice of Edmonton as opposed to Calgary.

2.1.2 Data Availability in Ten Canadian Cities

The determination of the trends in air quality obviously depends on the availability of monitoring data. In order to assist in city selection, the following criterion was deemed desirable in order to provide minimum data required for trend analysis on a city-wide basis:

> At least four years (preferably consecutive years) with adequate data recovery for at least four stations in each city and for four parameters (TSP, NO_2, O_3 and CO).

Adequate data recovery refers to the National Air Pollution Surveillance (NAPS) network criteria which require 50 % data recovery each year with at least two months data in each calendar quarter. Four parameters (instead of five) were selected since there was a limited amount of ambient hydrocarbon data for most cities.

The evaluation of data availability in the cities was carried out and included discussions with personnel from all major air quality networks in Canada. Published data summaries and network descriptions were also examined. Analysis of the data availability from the NAPS network in terms of the criterion, shows that only Toronto (six stations), Vancouver (six stations), Montreal (eight stations) and Edmonton (four stations) satisfied the criterion. The next lowest rank ed city in terms of the criterion was Winnipeg (three stations plus an additional station with a four year period that does not overlap with the other three stations).

2.1.3 Air Quality Data

Existing air quality in the ten cities was assessed by examining selected parameters from the 1981 air quality data from the NAPS network. This brief examination provided a "snapshot" of some aspects of the relative air quality in the various cities. This assessment was not intended to be an exhaustive or thorough analysis but was deemed suitable as a simple procedure to assist in selecting the cities to be examined in detail.

The parameters examined for each city include:

- number of stations
- number of stations with valid annual mean
- annual mean
- total number of exceedances of the air quality objective defining the lowest pollutant concentration
- number of exceedances per station.

The requirement for calculating a valid annual mean at a NAPS station reporting hourly data is 50 % data recovery for the year with data reported in at least two months in each quarter.

National air quality objectives for the pollutants CO, NO_2, and TSP are given in Table 2.2. The air quality objectives for which exceedances are quoted are as follows:

Ozone:	1 hour average maximum desirable air quality objective (50 ppb)
Nitrogen dioxide:	1 hour average maximum acceptable air quality objective (210 ppb)
Carbon monoxide:	1 hour average maximum desirable air quality objective (13 ppm)
TSP:	24 hour average maximum acceptable air quality objective (120 $\mu g\ m^{-3}$).

In cases where other objective levels exist (O_3, CO and NO_2), air quality objectives defining the lowest pollutant concentration would provide the largest numbers of exceedances and this would facilitate inter-city comparision.

Selected parameters for each of the pollutants ozone, nitrogen dioxide, carbon monoxide and total suspended particulates are tabulated in Tables 2.3 - 2.6. Hydrocarbon data are not available from the NAPS network and are not readily available for all ten cities and are therefore excluded from this analysis.

TABLE 2.2

NATIONAL AIR QUALITY OBJECTIVES

Pollutant	Maximum Desirable Level	Maximum Acceptable Level	Maximum Tolerable Level
Carbon monoxide			
Average concentration over a 8-h period	6 mg/m^3(5ppm)	15 mg/m^3(13 ppm)	20 mg/m^3(17 ppm)
Average concentration over a 1-h period	15 mg/m^3(13ppm)	35 mg/m^3(31 ppm)	
Nitrogen dioxide			
Annual arithmetic mean	60 μg/m^3(0.03 ppm)	100 μg/m^3(0.05 ppm)	
Average concentration over a 24-h period		200 μg/m^3(0.11 ppm)	300 μg/m^3(0.16 ppm)
Average concentration over a 1-h period		400 μg/m^3(0.21 ppm)	1000 μg/m^3 (0.53 ppm)
Oxidants (ozone)			
Annual arithmetic mean		30 μg/m^3(0.015 ppm)	
Average concentration over a 24-h period	30 μg/m^3(0.015 ppm)	50 μg/m^3(0.025 ppm)	
Average concentration over a 1-h period	100 μg/m^3(0.05 ppm)	160 μg/m^3(0.08 ppm)	300 μg/m^3(0.15 ppm)
Suspended particulate matter			
Annual geometric mean	60 μg/m^3	70 μg/m^3	
Average concentration over a 24-h period		120 μg/m^3	

* Conditions of 25° C and 101.325 kPa are used as the basis for conversion from μg/m^3 to ppm and ppb.

** Proposed.

Note:

The maximum desirable level defines the long-term goal for air quality and provides a basis for an anti-degradation policy for the unpolluted parts of the country and for the continuing development of control technology.

The maximum acceptable level is intended to provide adequate protection against adverse effects on soil, water, vegetation, materials, animals, visibility, personal comfort and well-being.

Maximum tolerable levels denote time-based concentrations of air contaminants beyond which, due to a diminishing margin of safety, appropriate action is required to protect the health of the general population

TABLE 2.3

SELECTED AMBIENT CARBON MONOXIDE CONCENTRATION STATISTICS FOR CANADIAN CITIES IN 1981

CITY	No. of Stations with Valid Annual Mean	Annual Mean (ppm)	Total No. of Exceedances#	Exceedances/ Station	Notes
Montreal	6 (10)	1.5	37	3.7	- 18 exceedances at Duncan/Decarie
Toronto	7 (10)	2.1	317	31.7	- 293 exceedances at 381 Yonge St. - (annual mean 4.3 ppm)
Vancouver	2 (4)	2.1	52	13	- 47 exceedences at Bobson/Hornby
Ottawa/Hull	3 (3)	1.4	3	1.0	- all 3 exceedances at 88 Slater Street
Winnipeg	1 (3)	0.90	0	0	
Edmonton	3 (3)	1.6	60	20.0	- 0 exceedances at 17 street & 105 Ave. - 41 exceedences at 10255 and 104th St.
Quebec City	1 (1)	1.5	9	9.0	
Hamilton	1 (1)	1.20	3	3.0	
Calgary	2 (2)	1.65	69	34.5	- 63 exceedances at 1111 - 104th Street
Halifax	0 (1)	-	17	17	- insufficient data for calcaluation of valid mean

* Number in parentheses is total number of NAPS stations

# Number of exceedances of 1 hour average maximum desirable air quality objective (13 ppm)

TABLE 2.4

SELECTED AMBIENT NITROGEN DIOXIDE CONCENTRATION STATISTICS FOR CANADIAN CITIES IN 1981

CITY	No. of Stations with Valid Annual Mean	Annual Mean (ppm)	Total no. of Exceedances#	Exceedances/ Station	Notes
Montreal	2 (9)*	0.022	5	0	
Toronto	6 (9)	0.027	0	0	
Vancouver	3 (5)	0.025	0	0	
Ottawa/Hull	4 (4)	0.016	0	0	
Winnipeg	1 (2)	0.021	0	0	- Jefferson & Scotia Station, calculated annual mean <.01 ppm
Edmonton	2 (2)	0.036	1	0.5	
Quebec City	1 (1)	0.027	18	18	
Hamilton	2 (2)	0.028	2	1	
Calgary	2 (2)	0.028	0	0	
Halifax	1 (2)	0.040	0	0	- CFB Shearwater Station, calculated annual mean <0.01 ppm

* Number in parentheses is total number of NAPS stations

# Number of exceedances of 1 hour average maximum acceptable air quality objective (0.21 ppm)

TABLE 2.5

SELECTED AMBIENT OZONE CONCENTRATION STATISTICS FOR CANADIAN CITIES IN 1981

CITY	No. of Stations with Valid Annual Mean	Annual Mean (ppm)	Total no. of Exceedances#	Exceedances/ Station	Notes
Montreal	5 (10)*	0.013	1326	133	- 558 exceedances at Pie X & Cardinal
Toronto	5 (8)	0.013	1643	205	- 357 exceedances at Don Mills Science Centre
Vancouver	1 (5)	0.010	413	83	- annual mean at Rocky Pt. Park invalid however station had 289 exceedances
Ottawa/Hull	3 (3)	0.013	248	83	- fewest exceedances at 88 Slater St.
Winnipeg	2 (2)	0.015	95	48	- greatest no. of exceedances at 65 Ellen Street (72)
Edmonton	2 (2)	0.015	350	175	- greatest no. of exceedances at 127 St. & 133 Ave. (308)
Quebec City	2 (2)	0.0091	27	14	
Hamilton	1 (1)	0.016	280	280	
Calgary	2 (2)	0.015	207	14	- greatest no. of exceedances at 39 St. & 29 Ave. NW (183)
Halifax	1 (2)	0.008	1	1	

* Number in parentheses is total number of NAPS stations

# Number of exceedances of 1 hour average maximum desirable air quality objective (.05 ppm)

TABLE 2.6

SELECTED AMBIENT TSP CONCENTRATION STATISTICS FOR CANADIAN CITIES IN 1981

CITY	No. of Stations with Valid Annual Mean	Annual Mean (µgm)^{3}	Total no. of Exceedances#	Exceedances/ Station	Notes
Montreal	9 (14)*	64	78	5.6	- Duncan/Decarie greatest no. of exceedances (32)
Toronto	6 (10)	73.5	73	7.0	- greatest no. of exceedances at Sherbourne Wilton St.
Vancouver	10 (12)	48.4	73	2.6	
Ottawa/Hull	4 (4)	43.3	0	0	
Winnipeg	5 (5)	55.0	24	4.8	
Edmonton	3 (3)	77.3	37	12.3	- greatest no. of exceedances at 10255 & at 104th street (23)
Quebec City	1 (4)	42	9	2	
Hamilton	3 (3)	75	26	8.6	
Calgary	3 (3)	116.6	78	16.0	- least no. of exceedances at 39 St. and 29 Ave. W. (7)
Halifax	3 (4)	28.7	0	0	

* Number in parentheses is total number of NAPS stations

# Number of exceedances of 24 hour average maximum acceptable air quality objective (120 µg m^{-3})

In general, the rankings of the cities in terms of annual means and exceedances of air quality objectives for TSP, CO and (less so) O_3 were similar. The exceedances of the air quality objective for NO_2 were too few to provide meaningful evaluation of any relation to annual means.

The ranking of the means and exceedances/station was not always similar to the population ranking. Notable exceptions follow.

The highest TSP annual means and exceedances/station were shown by Calgary and Edmonton. The Edmonton TSP levels may be largely determined by one station which had 62 % of the exceedances in 1981. In general however, TSP levels in Prairie cities tend to be high.

For ozone, there was relatively little difference in the annual means in the four cities with the highest means (Hamilton, Edmonton, Winnipeg and Calgary).

The CO data show that Toronto, Vancouver, Edmonton and Calgary were the cities with highest CO annual means or with the greatest number of exceedances/station of the 1 hour average desirable air quality objective for CO.

The NO_2 data provided little information regarding the exceedances since in most cities there were no exceedances of the air quality objectives. The annual mean NO_2 level was highest for Halifax but data were only available at one station which is probably strongly influenced by traffic sources (Concord Scientific Corporation, 1983).

Summary

The cities of Toronto, Montreal, Vancouver and Edmonton were selected for detailed air quality trend and emission inventory analyses based on the evaluation of the fraction of total Canadian population, the fraction of gasoline sales and the Canadian automobile fleet in each city, the availability of emissions inventory and air quality data, and air quality in 1981.

2.2 Data Sources and Data Availability

Monitoring authorities in each of the four cities selected for detailed analyses were contacted regarding potential sources of air quality data. In general, NAPS data were obtained for all cities and were supplemented with additional data obtained from provincial and/or municipal agencies. In some cases, further data were potentially available from industrial sources, however this data often did not meet the selection criterion of four consecutive years data in one monitoring location, or the existing data format did not permit data transfer (i.e., data were not available in computer compatible format).

Each of the agencies that provided data also provided a site description for each of the monitoring locations and a summary of the data validation and QA/QC procedures applied to network operations. The descriptions of data QA/QC procedures were used to ensure that only valid data were included in the data base for subsequent manipulation and analysis, and to assess data comparability (in terms of analysis techniques and data handling) between stations and over time. In general, similar data validation procedures were applied by the various monitoring agencies. During the earlier years of the study period, data quality control consisted of "qualitative and semi-quantitative examinations of data and monitoring methods by senior network personnel". QA/QC procedures improved with time and experience, to include regularly scheduled (and monitored) calibration and maintenance, routine checks of instrument performance (zero and span checks) and computer checks of data consistency. While no quantitative estimates of data quality were available (i.e., published statements of data accuracy/precision etc.), it is apparent that overall data quality has improved with time.

The QA/QC steps applied to the data used for this investigation consisted of the following:

1) NAPS data summaries were compared to those generated by other agencies to investigate the consistency of reported values and data validity.

2) Computer summaries of the data tapes provided were used to compare the actual data obtained, with that published by the various agencies.

3) Data that were inconsistent (i.e., disagreements between NAPS or provincial hardcopy data and computer summary of raw data) were investigated in detail for correction or deletion from the data set.

4) Any data that were considered "invalid" by either NAPS or the other agencies were not included.

Some of the major data quality related points that resulted in the exclusion of data are given below.

- With the exception of Ontario data, O_3 data collected prior to 1978 were of questionable merit due to instrument calibration problems. These data were therefore excluded.

- NO_2 data prior to 1978 were generally unreliable due to inconsistencies in measurement techniques and were for the most part also excluded. Consequently, NO_2 data in Edmonton prior to 1975 were excluded and NO_2 data for Montreal and Vancouver prior to 1978 were excluded.

Once the validity of the data was established, data availability summaries were generated to permit the selection of data for detailed analysis based on data quality and availability and monitoring station characteristics. Monitoring station characteristics such as location, proximity to industrial sources of air pollution and traffic volume, were examined in order to classify stations as residential (R) - having no significant local industrial or traffic sources, or non-residential (S) - those which do have significant local sources (traffic related or industrial sources).

The availability of valid data is illustrated in Appendices A1.1 to A1.4 for Toronto, Montreal, Vancouver and Edmonton respectively. The details of the monitoring stations and selection of data source (when duplicate data were available) are described in Appendices A2.1 to A2.4 for the four cities. The station classification (S for source-affected and R for residential) was used to separate station groups in subsequent analyses (see below). The data availability, and station groupings for each of the four cities are described below.

2.2.1 Data sources: Toronto

Data for the Metropolitan Toronto area were obtained from the NAPS network, and the Ontario Ministry of the Environment (OME). The O_3, NO_2, CO and TSP data were provided by both agencies, while the total hydrocarbons data (THC) were provided by OME only. The data summary (see Appendix A1.1) indicates that gaseous air quality data were available for at least seven out of eight different locations for various time periods in excess of four years. There were as many as 14 stations reporting TSP data.

Of the stations measuring gaseous pollutants, there was only a single station (30400002 at the Ontario Science Centre) that was classified as a residential station (see Appendix A2.1). The remaining stations were found to have significant traffic or industrial sources nearby.

2.2.2 Data Sources: Montreal

The availabililty of air quality data collected in the Montreal urban area is summarized in Appendix A1.2. Some aspects of the air quality in the Montreal area for the period 1979-1982 were recently investigated (Concord Scientific Corporation, 1983) as part of a detailed study of the oxidant problem in the Montreal/Quebec City area. That investigation included a detailed analysis of the trends in O_3, NO_2 and hydrocarbons for the period as well as the relationships between the pollutant species. As a result of that work, an archive for O_3, NO_2 and THC data was established for all stations in the Montreal Region and Quebec City. The data included in the archive were originally obtained from NAPS, the Communauté Urbaine de Montréal (CUM) and the Quebec Ministry of the Environment. For the present investigation (of longer term trends, and for additional pollutant species), the data base was supplemented with available NAPS data for CO and TSP for the period 1970 to 1981. Of the fifteen stations monitoring air quality in the Montreal area, ten monitor gaseous air pollutant species and TSP, while the remainder monitor TSP only. Hydrocarbon data in the Montreal area were limited to some special studies carried out only during part of 1978. These data were not used in this investigation since they were insufficient to determine any trends.

The station classification for Montreal resulted in a total of six residential stations (for gaseous data) and four non-residential. For the stations measuring TSP only, one was a residential station, while the others were source or traffic affected and therefore classified as nonresidential.

2.2.3 Data Sources: Vancouver

Some of the air quality data available for the Vancouver area (see Appendix 1.3) was also available in archived format as a result of an earlier data analysis project (Concord Scientific Corporation, 1982) investigating oxidants in the Vancouver and Lower Fraser Valley area. The archive with O_3 and NO_2 data for the period 1977-1981 was supplemented with NAPS data for TSP and CO for the period 1970-1981. Data from a total of thirteen monitoring stations were used for this investigation. There was a considerable amount of monitoring data (mostly TSP) collected by the Greater Vancouver Regional District (GVRD) at other monitoring locations. However, these data were not available in a computer compatible format and were therefore not included in the study.

Of the thirteen monitoring stations included, eleven measured various gaseous species (particularly O_3 and NO_2), while two reported TSP only. The station classification (Table 2.8) resulted in approximately equal numbers of residential (seven) and non-residential stations (six).

2.2.4 Data Sources: Edmonton

The air quality data investigated for the Edmonton area (Appendix A1.4) were provided by NAPS and Alberta Environment for four gaseous monitoring stations (one residential and three non-residential stations) and three TSP stations. Alberta Environment provided all the total hydrocarbons data as well as all data at the EDMU station in downtown Edmonton. The remaining data were taken from NAPS data files (Appendix A2.4).

An additional data source that was investigated for the Edmonton area was the Strathcona Industrial Association monitoring network in eastern Edmonton that is maintained by the petroleum refining industry. Discussions with the association (P. Knettig, 1983), however, revealed that the majority of the data collected by the stations (some since 1974) were not available in computer compatible format. It is expected that the data collected by the NAPS/Alberta Environment station in eastern Alberta (NAPS station number 90121 or EIMU) would provide data representative of air quality in this area.

3. DATA ANALYSIS

The following tabulations are provided for each pollutant and for each of three groupings of stations (all stations, residential and non-residential stations) in each city:

a) Composite monthly and annual mean concentrations and the % data recovery for each year.

b) The number of valid days each year, the daily mean concentrations corresponding to the 10th, 25th, 50th, 75th, 90th and 99th percentiles of the distribution, the composite annual mean and the maximum daily mean. These data are provided for each year.

c) A summary of the appropriate numbers of exceedances of national air quality objectives each year together with the number of stations, the percentage data recovery for all stations in the group and the maximum daily and hourly mean concentrations.

The terminology used in the tables is given below. Mathematical formulas used are detailed in Appendix J.

a) Composite monthly means:

The composite monthly means are the sum of all hourly values at each station in the particular group divided by the total number of hourly observations at all stations in the group.

b) The composite annual means are calculated as in a) but the time period is 1 year.

c) The % data recovery is based on the number of possible hourly observations each year, thus

$$\%\ \text{data recovery} = \frac{\text{Total number of hours of data available}}{\text{Number of stations} \times \text{number of hours in calendar year}}$$

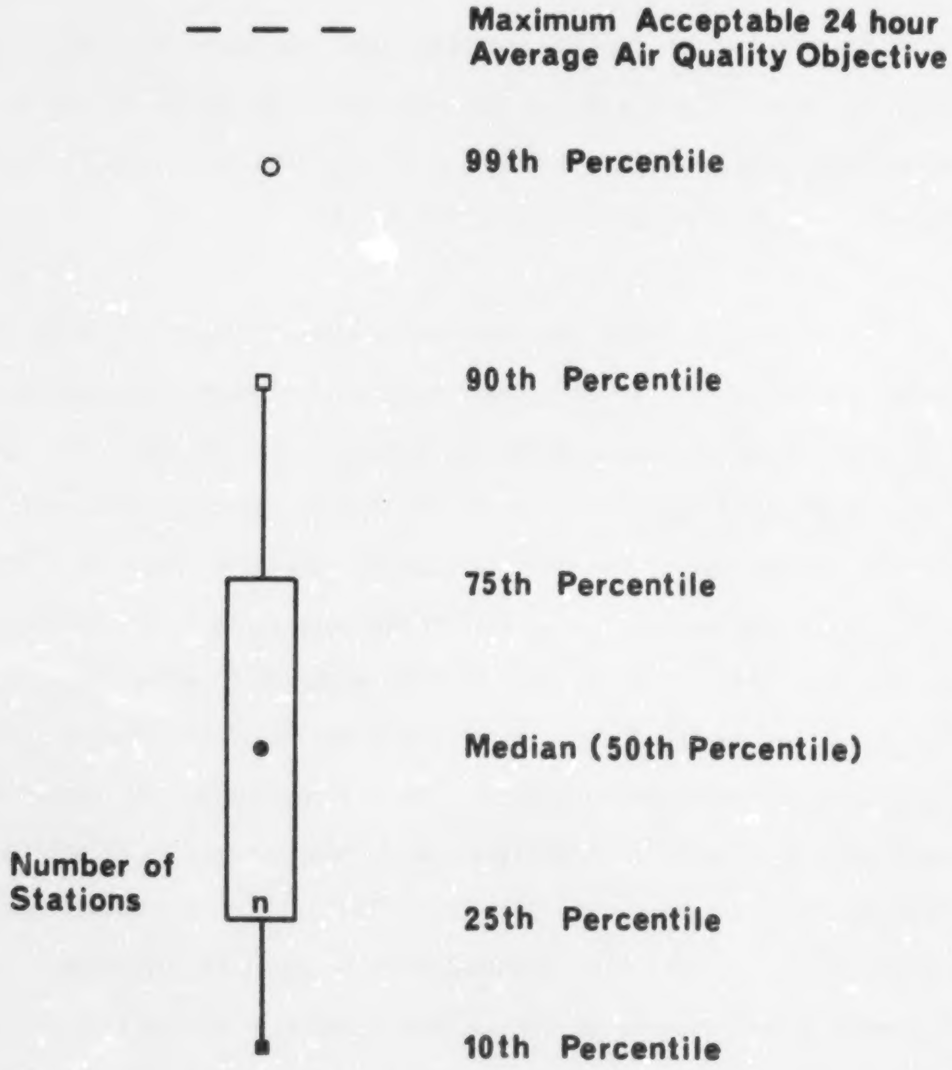
d) A valid day is defined as one having sixteen or more hourly values. Daily means for valid days are used in the determination of the daily mean concentrations for the various percentiles. The annual mean quoted in the percentile distribution table are calculated as in b) but for valid days only. The term valid day used in the TSP tables refer to a day with a valid 24 hour sample.

3.1 Trend Analysis

The trends in the air quality data for each city will be discussed in turn. This will be followed by a discussion of overall trends for each pollutant. Tabulations of the data are given in four Appendices - one for each city (Appendices B - E)

Two types of plots are provided within the text for each of the three groupings of stations: composite annual means for each year with an indication of the numbers of stations used to calculate the composite mean and a box plot on which the concentrations corresponding to various percentiles of the distribution of the daily means each year are indicated. Figure 3.1 is a key to the box plots. It should be noted that the indication of the maximum acceptable annual mean air quality objective on the former plots refers to individual stations and merely provides a frame of reference. On the box plots, the number of stations each year are also indicated, as is the maximum acceptable air quality objective averaged over 24 hours. This allows a rough estimate of the percentage of data that exceeded this air quality objective. The exact number of exceedances of the maximum acceptable air quality objectives averaged over 24 hours are tabulated in Appendices B-E. A third type of plot - composite monthly means for each of the groups of stations versus time -is also provided in Appendices F through I.

FIGURE 3.1 Key to Box Plots for the Frequency Distribution of 24 hour Average Pollutant Concentrations


Maximum Acceptable 24 hour Average Air Quality Objective
99th Percentile
90th Percentile
75th Percentile
Median (50th Percentile)
Number of Stations
n
25th Percentile
10th Percentile

3.2 Air Quality Trends: Toronto

3.2.1 Toronto: Carbon Monoxide

The composite annual mean CO concentrations for all the Toronto stations show a general decrease in levels between 1970 and 1981. The largest decrease occurred between 1974 and 1975. Plots of the composite annual means for the three groups of stations are shown in Figure 3.2a. Box plots are shown in Figures 3.2b, 3.2c and 3.2d.

The box plots for the data from all stations (Figure 3.2b) also show general decreases in all percentiles with the most dramatic decrease also occurring between 1974 and 1975.

Tabulations of the numbers of exceedances of the maximum desirable (13 ppm) and maximum acceptable (31 ppm) air quality objective CO concentrations averaged over a 1 hour period are given in Appendix B1.3.

The numbers of occasions on which the maximum desirable level averaged over 1 hour (13 ppm) was exceeded also showed a general decline between 1970 and 1981. The highest number of exceedances of this objective occurred in 1973 (239 exceedances). In contrast, over the last six years, there were ten (in 1977) or fewer exceedances of the objective each year. The maximum acceptable level for CO (31 ppm) averaged over a 1 hour period, was never exceeded.

Figure 3.2a Toronto Stations: Composite Annual Means of the hourly CO Concentrations

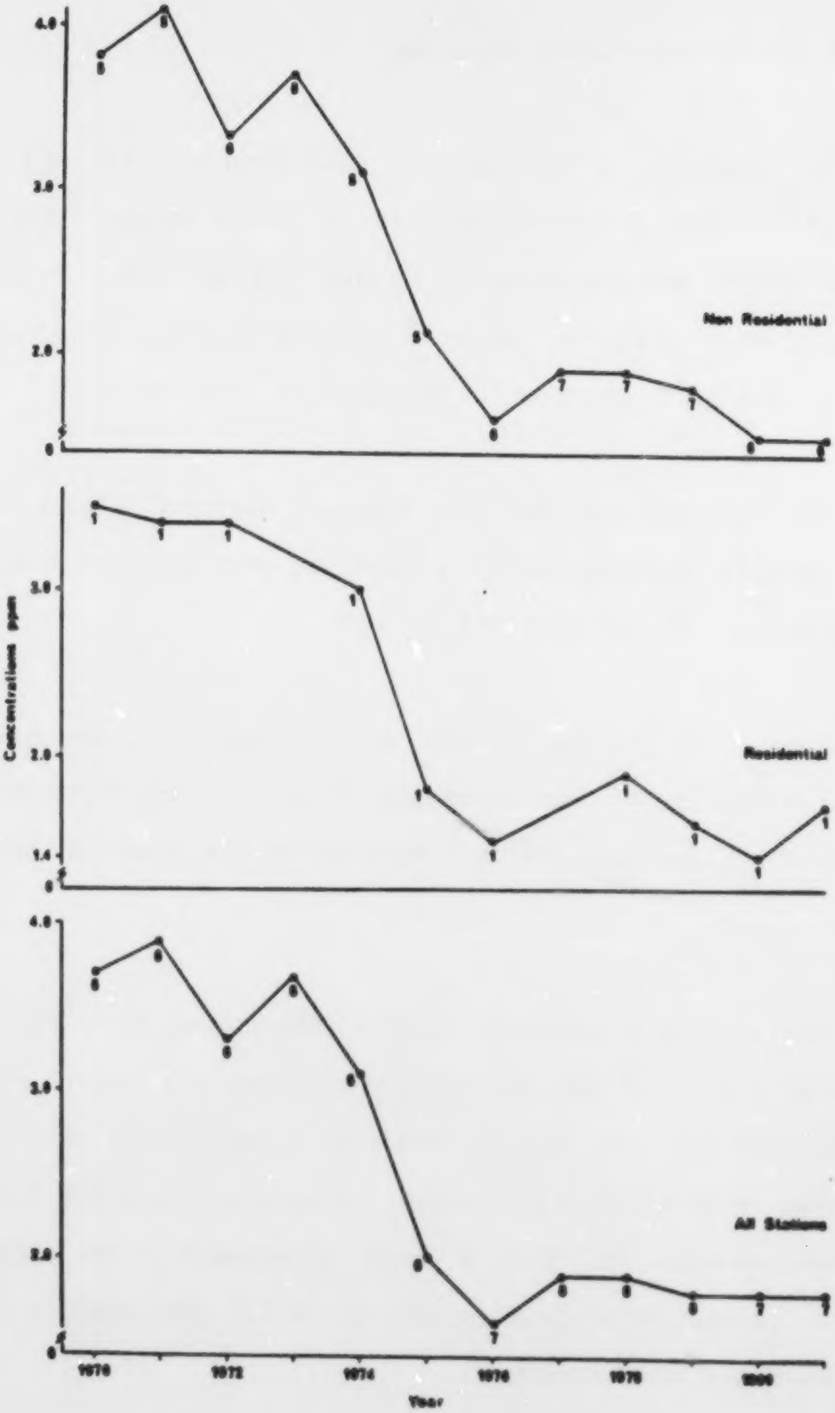


Figure 3.2b Toronto; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations

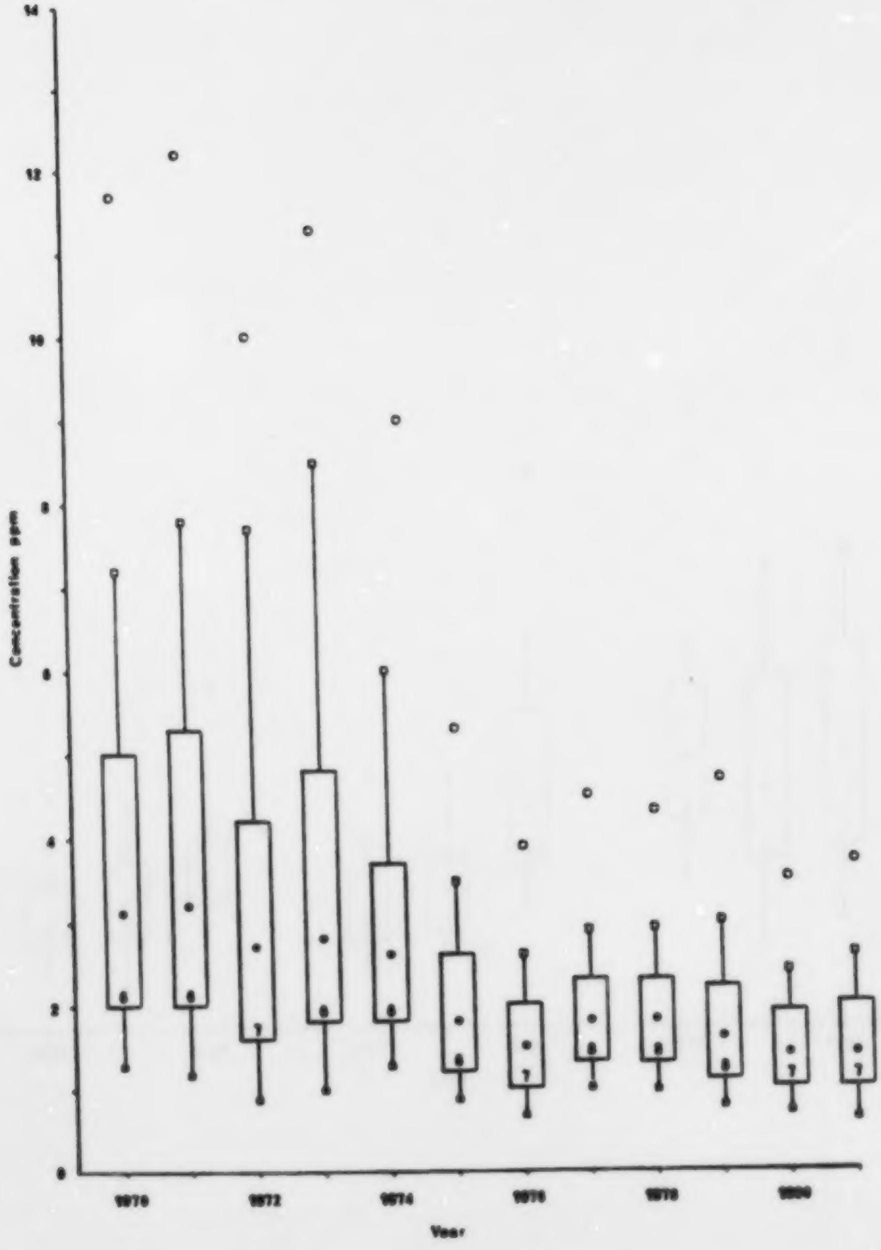


FIGURE: 3.2c Toronto: Residential Station: Box Plots for the Annual Frequency Distribution of 24 hour Average CO Concentrations

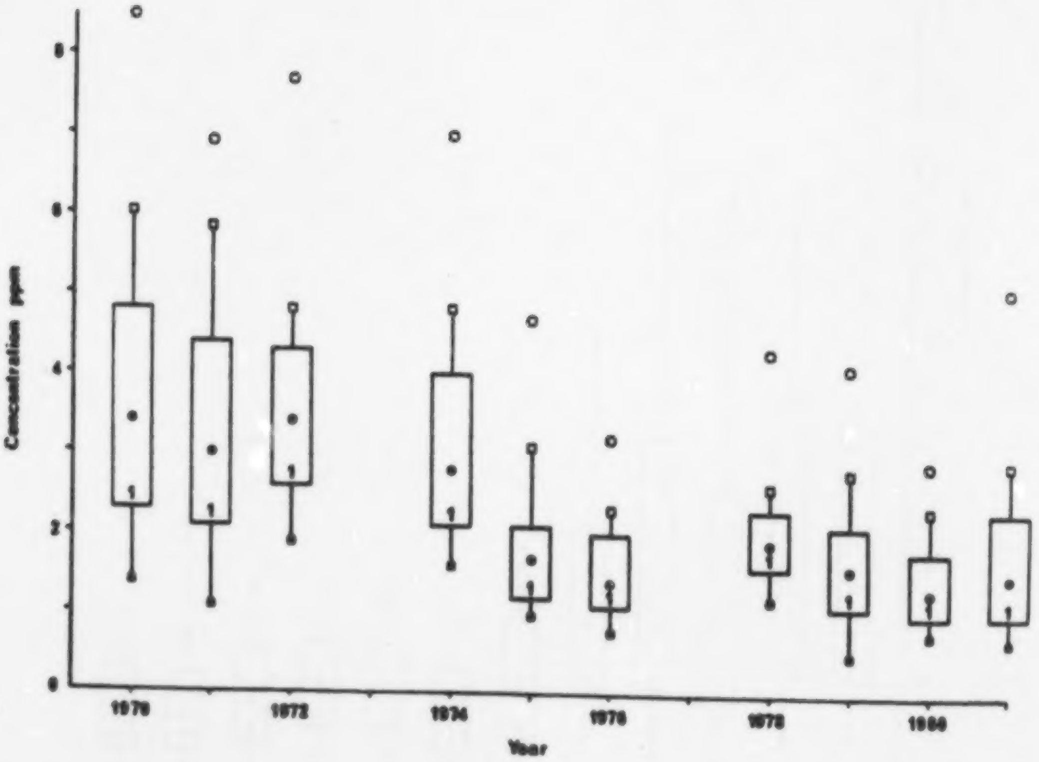
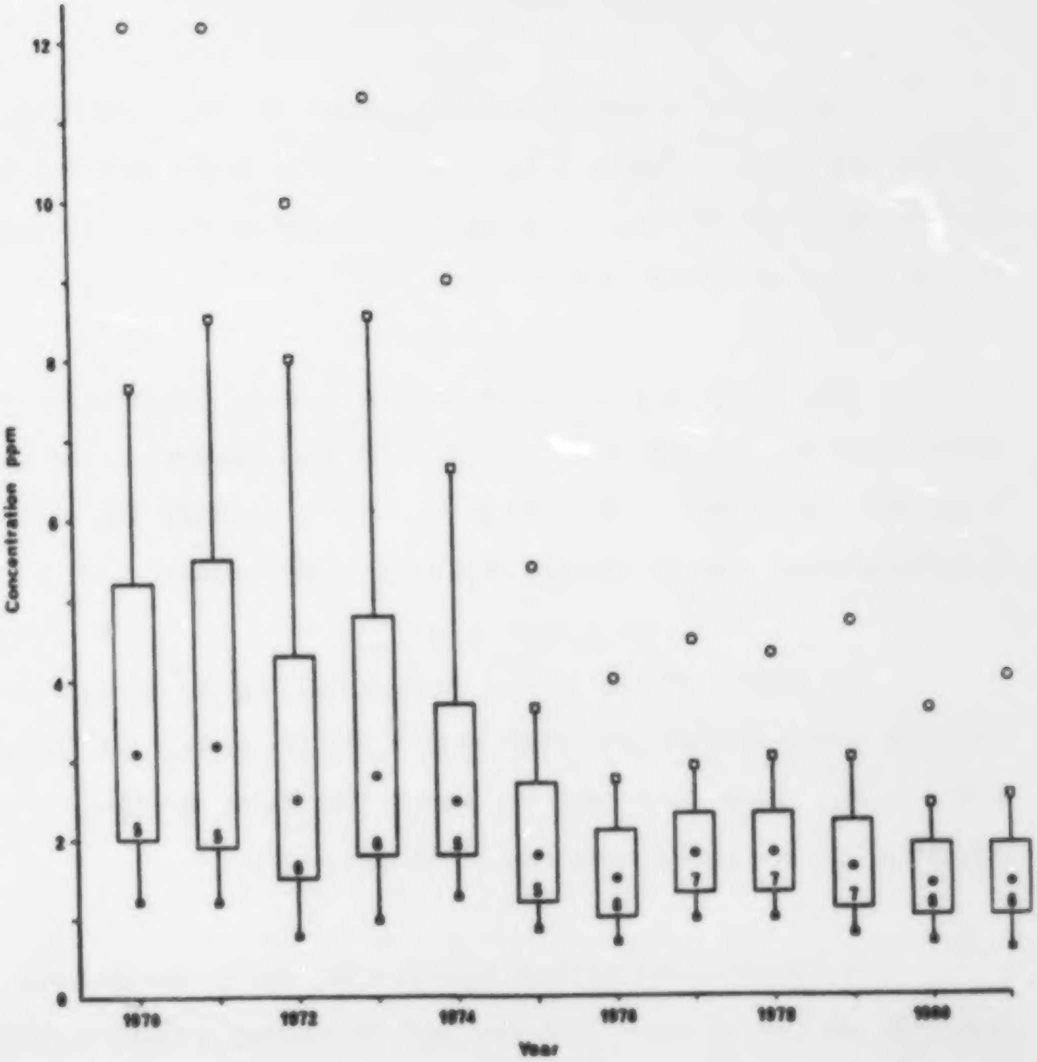


FIGURE 3.2d Toronto; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations



The variation of composite monthly mean CO levels are illustrated in Appendices F1.1 - F1.3. Between 1970 and 1973 there were relatively large variations in the monthly means with a tendency for higher levels to occur between June and October. In subsequent years, no consistent seasonal patterns in the CO levels were evident.

3.2.2 Toronto: Nitrogen Dioxide

The composite annual mean NO_2 concentrations for the Toronto stations are shown in Figure 3.3a. The composite annual mean for all stations decreased consistently since 1977; a similar pattern is shown for the single residential station since 1978.

This latter station had a relatively large reduction in the annual mean NO_2 concentration in 1981 (13.5 ppb) compared to the previous year (20.0 ppb). No station in Toronto exceeded the maximum acceptable annual mean air quality objective. (See Appendix B2.1).

The trends of the various percentiles for the NO_2 data from the three groups stations are illustrated in the box plots - see Figures 3.3b - 3.3d. Since 1977 there has been a consistent decrease in the concentrations corresponding to nearly all percentiles.

In Toronto, the maximum tolerable NO_2 levels averaged over 1 hour (530 ppb) or 24 hours (160 ppb) and the maximum acceptable level averaged over 24 hours (110 ppb) were never exceeded. However, the

FIGURE 3.3a Toronto Stations: Composite Annual Means of the Hourly NO_2 Concentrations.

Dashed line indicates the National maximum acceptable air quality objective level for the annual arithmetic mean NO_2 concentration.

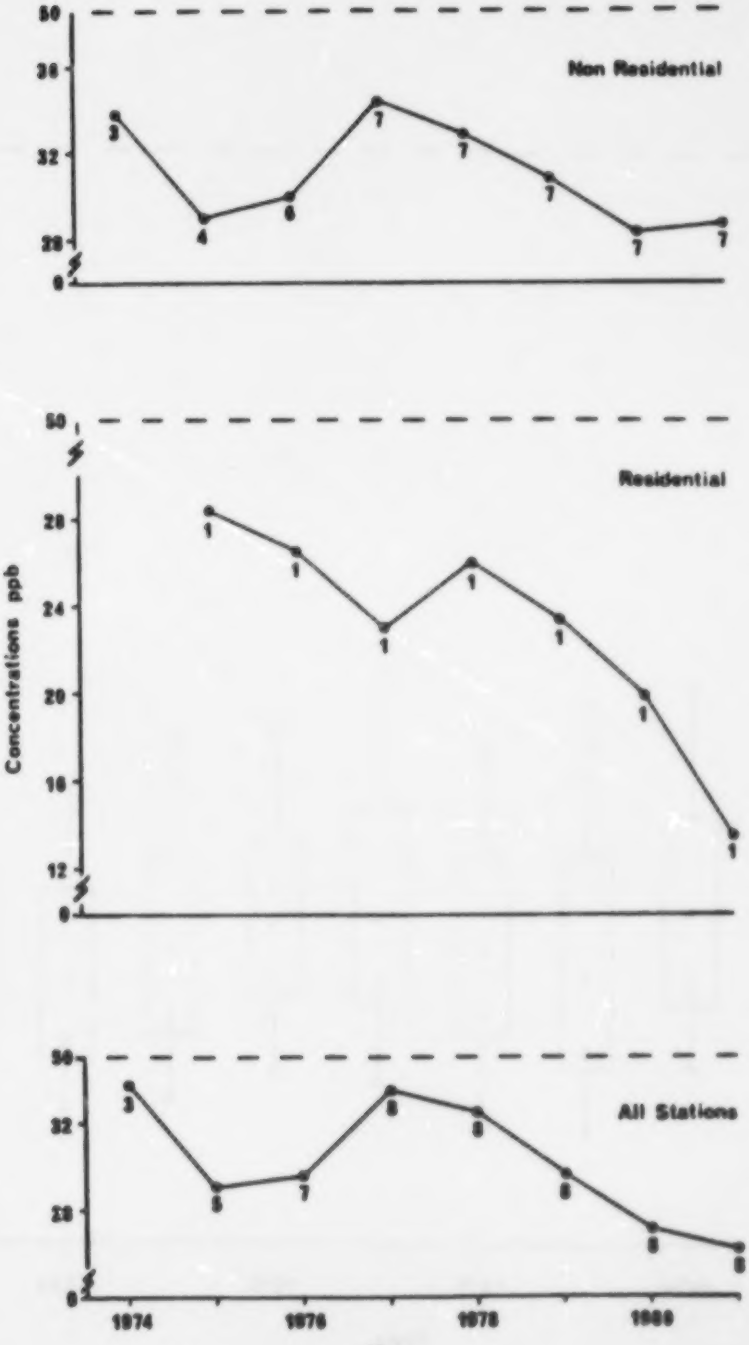


FIGURE 3.3b Toronto; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations

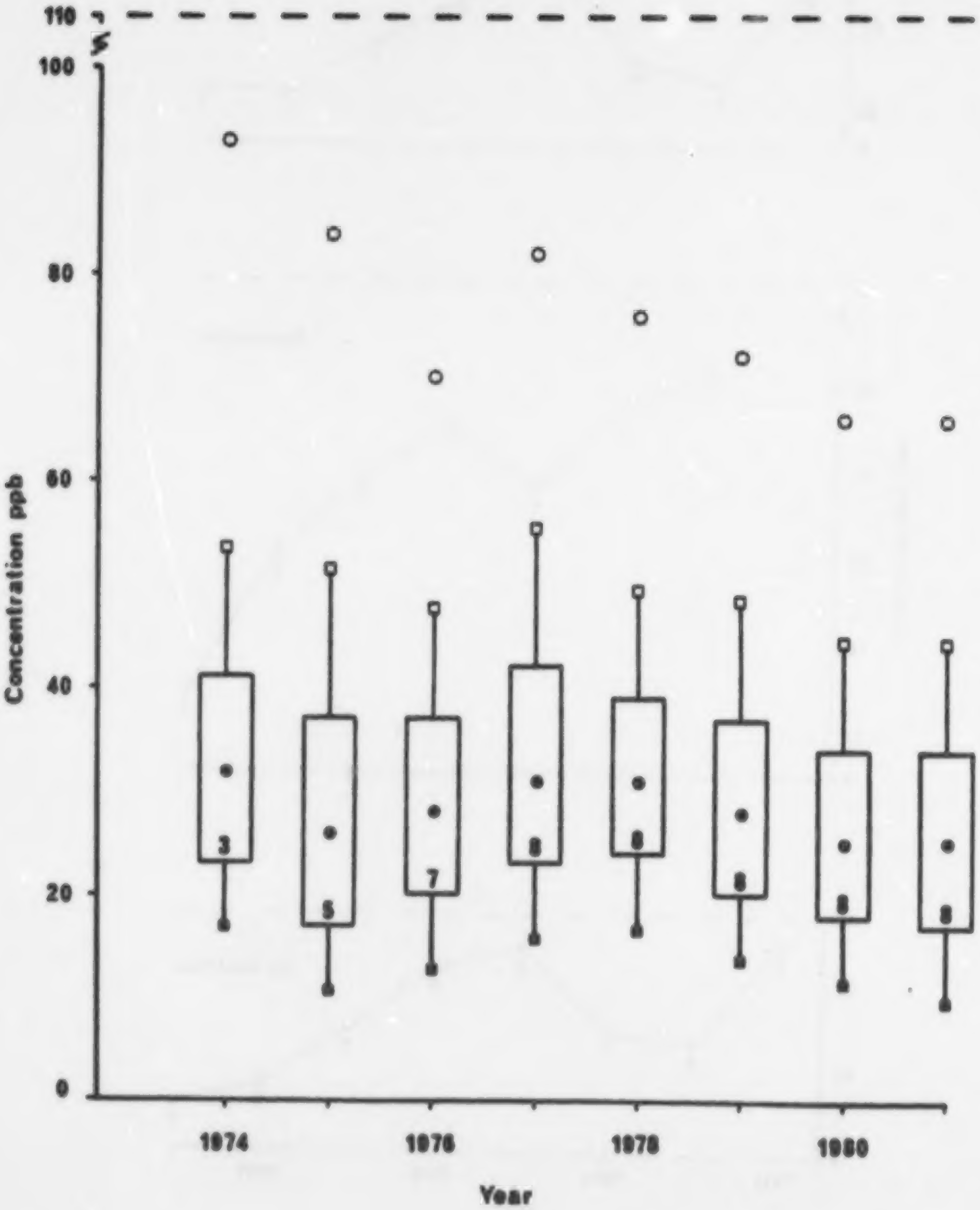


FIGURE 3.3c Toronto; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations

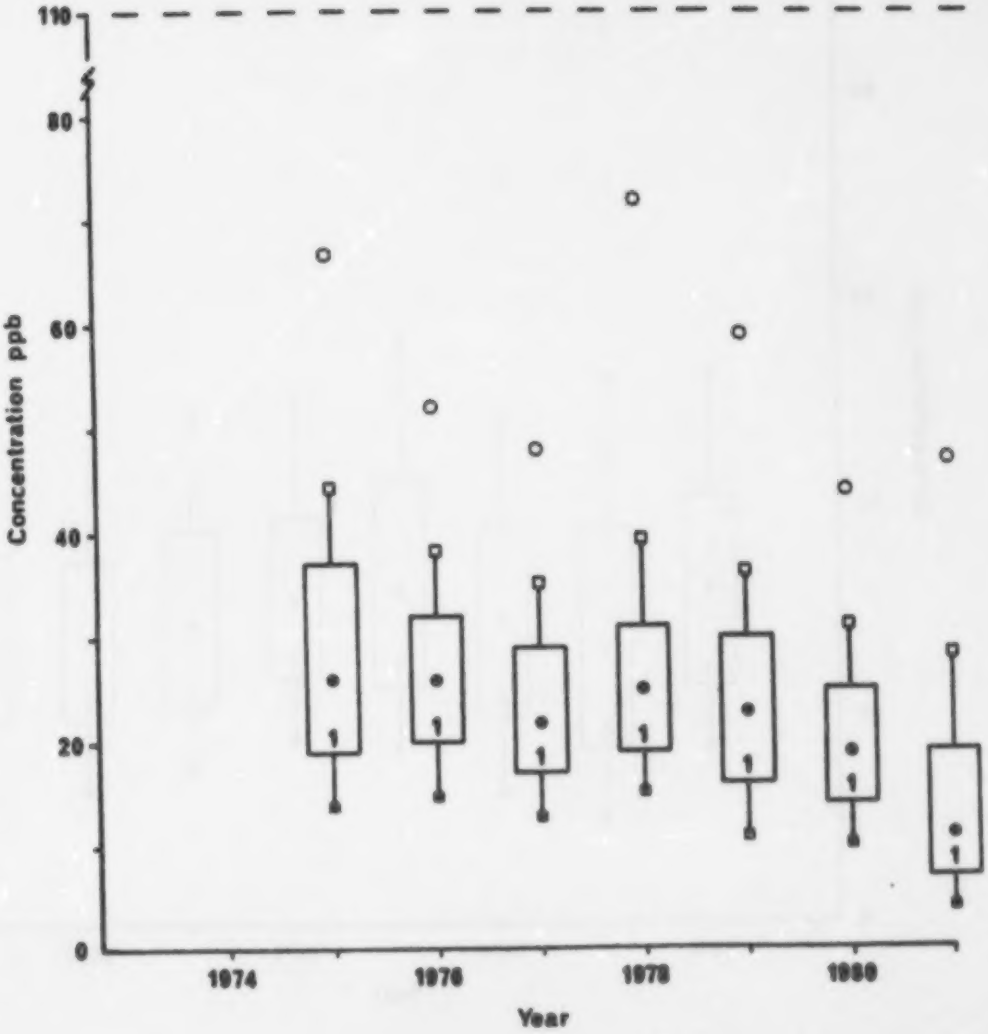
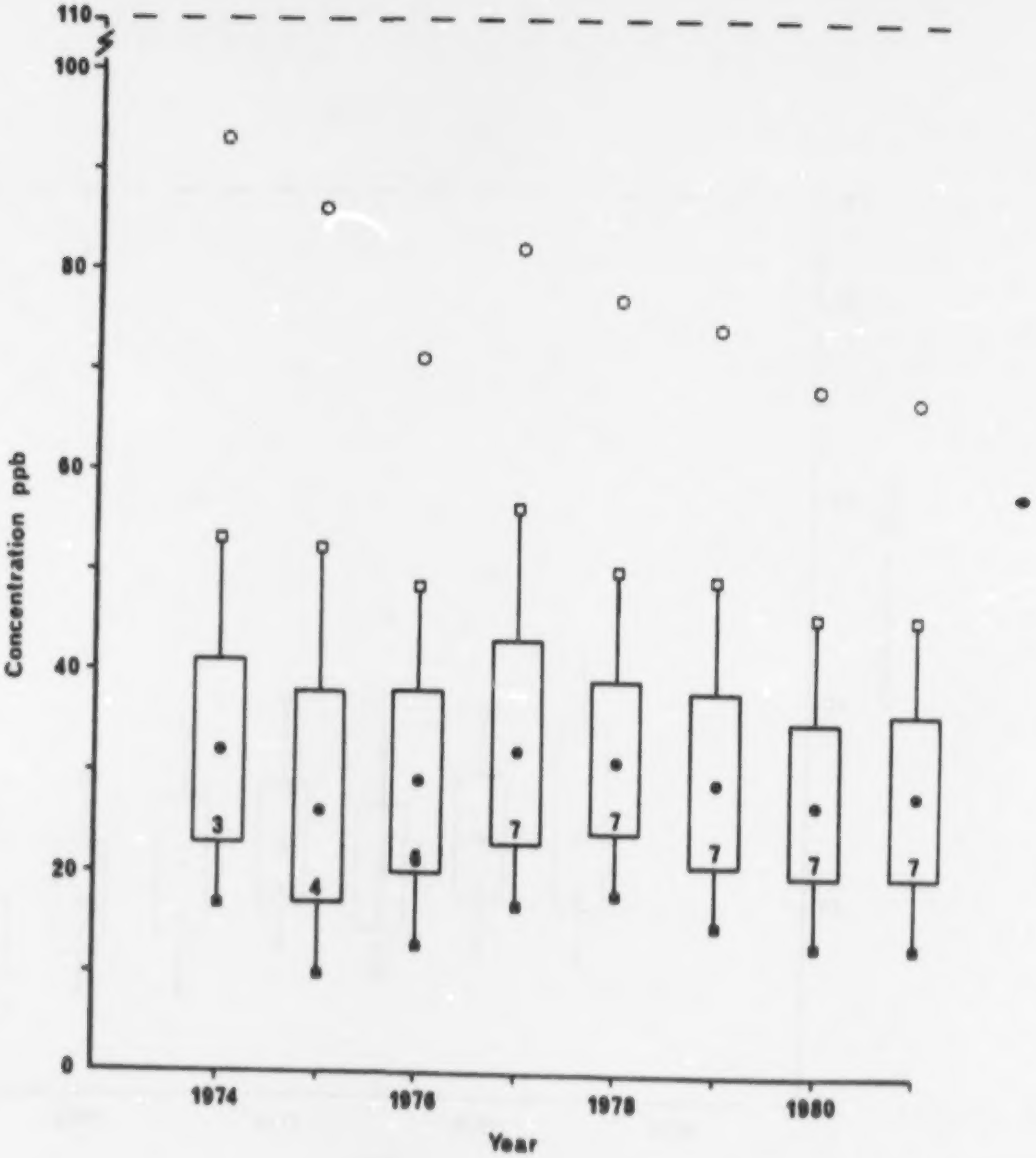


FIGURE 3.3d Toronto; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations



maximum acceptable NO_2 level averaged over 1 hour (210 ppb) was exceeded seven times in 1975, five times in 1976 and once each in 1978 and 1980.

The monthly mean NO_2 levels are generally lowest in the colder months (December, January and February) and highest levels are recorded between May and August. The reason for this pattern is not evident without further analysis of meteorological factors peculiar to Toronto or analysis of the pattern of NO_x emissions throughout the year. The plots of the composite monthly means are illustrated in Appendices F2.1 - F2.3.

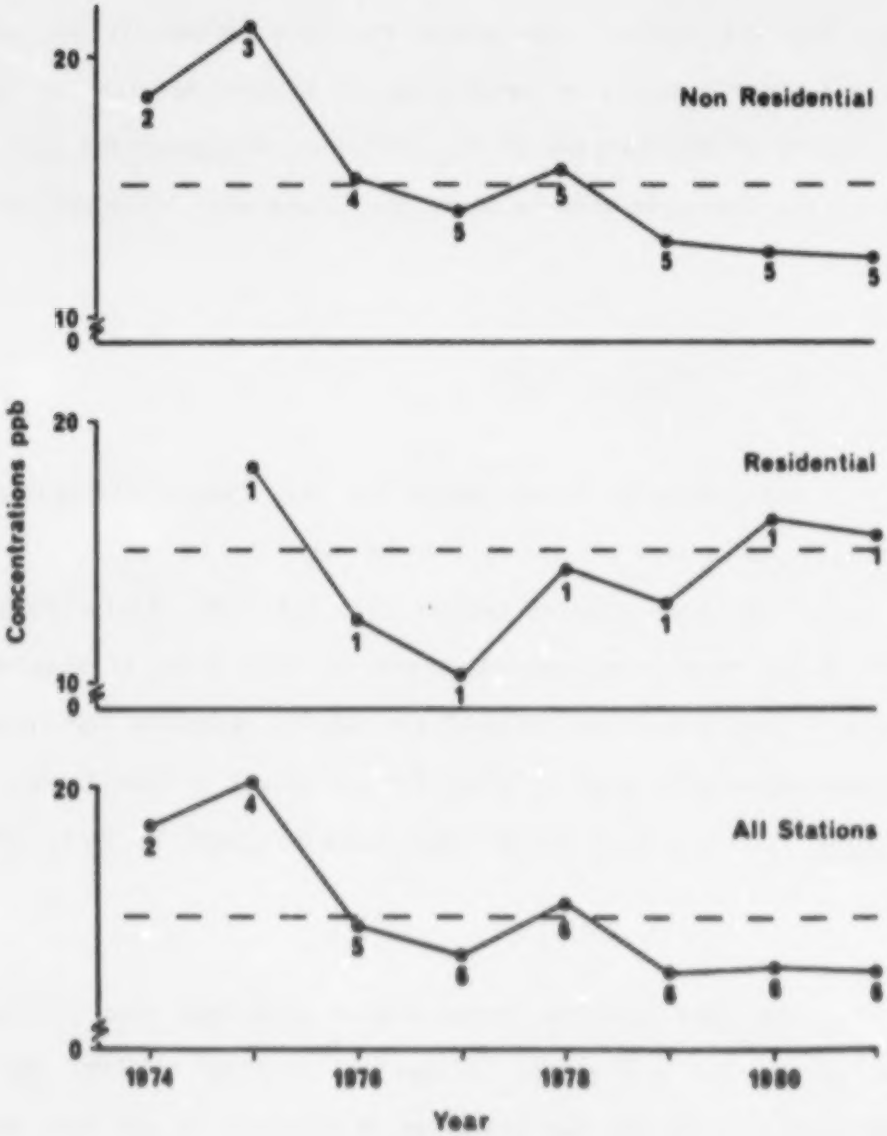
3.2.3 Toronto: Ozone

The composite annual means for the ozone concentrations in Toronto showed a general downward trend over the period 1974 to 1981. The largest decrease occurred between 1975 and 1976. Plots of the composite annual mean ozone concentrations for each group of stations are shown in Figure 3.4a. The national air quality objective for ozone sets a maximum acceptable level of 15ppb for the annual arithmetic mean. The composite (all stations) annual mean exceeded 15ppb in 1974, 1975 and 1978.

The data from the three station groupings show similar patterns except for the single residential station in 1980 and 1981. Comparisons between the two groupings of stations is not very meaning-

FIGURE: 3.4a Toronto Stations: Composite Annual Means of the hourly O_3 Concentrations

Dashed line indicates the National maximum acceptable air quality objective for the annual arithmetic mean O_3 concentration.



ful, since there was only one station meeting the criteria for classification as a residential station.

The percentile distribution of the composite data from all stations for each year are given in the box plots in Figures 3.4b -3.4d. The largest changes are exhibited for the higher percentiles and a trend towards lower levels is suggested.

The maximum desirable and maximum acceptable air quality objectives averaged over 1 and 24 hours, were exceeded in Toronto every year. Maximum tolerable level averaged over 1 hour was exceeded in three years 1974, 1975, and 1979 with most occurrences in 1975. See Appendix B3.3.

The occurrence of elevated ozone levels is very much dependent on the coincidence of meteorological conditions conducive to poor dispersion and mix of ozone precursor pollutants which may be from local emissions or transported from distant sources. The interpretation of trends in the numbers of exceedances of the various air quality objectives for ozone in terms of changes in local precursor emissions is therefore to be approached with caution. This question will be addressed in the discussion of the impact of future emissions on air quality.

The composite (all stations) monthly mean concentrations for ozone over the period 1974 to 1981 are plotted in Appendices F3.1 - F3.3. The ozone data show strong seasonal dependence with higher levels

FIGURE: 3.4b Toronto; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations

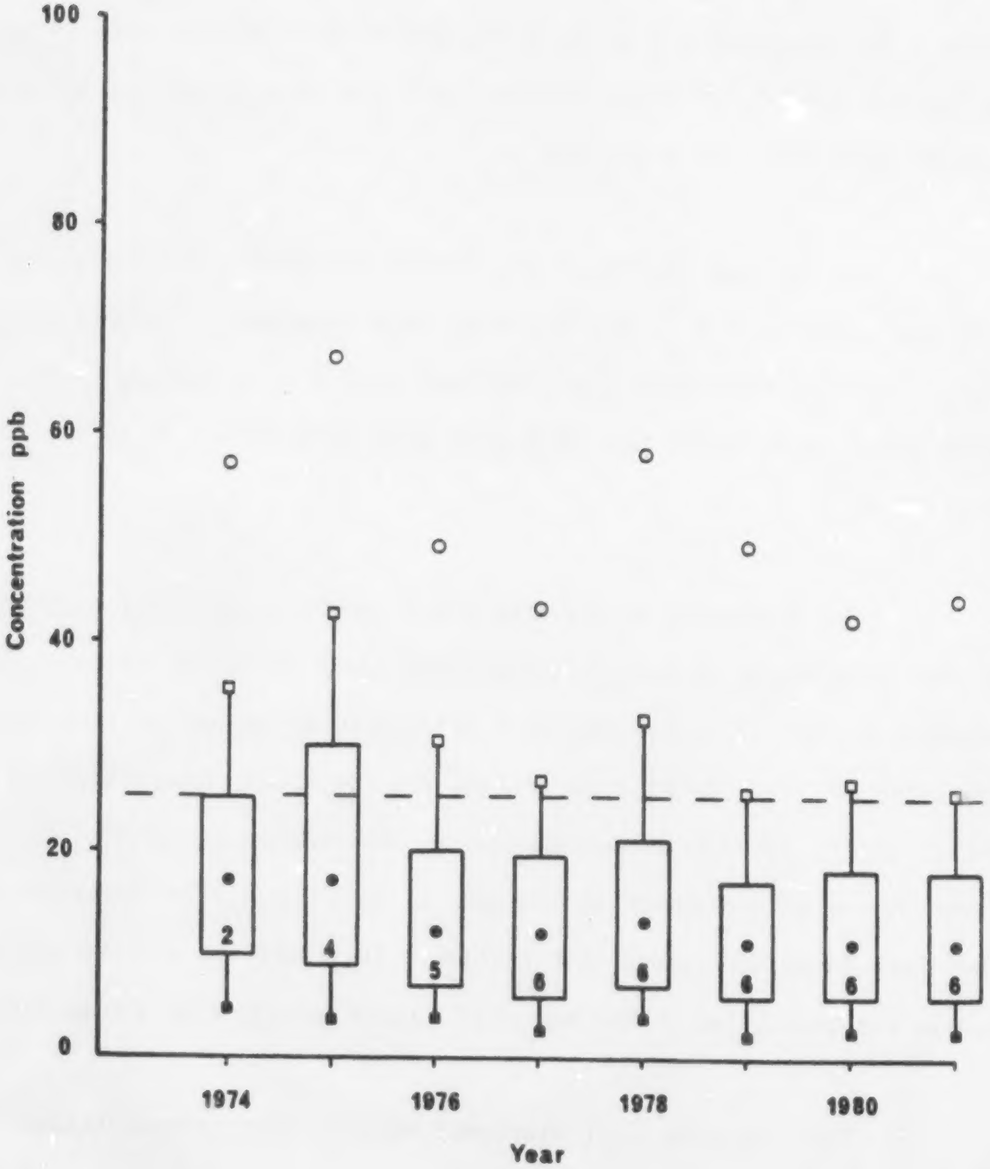


FIGURE: 3.4c Toronto; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations

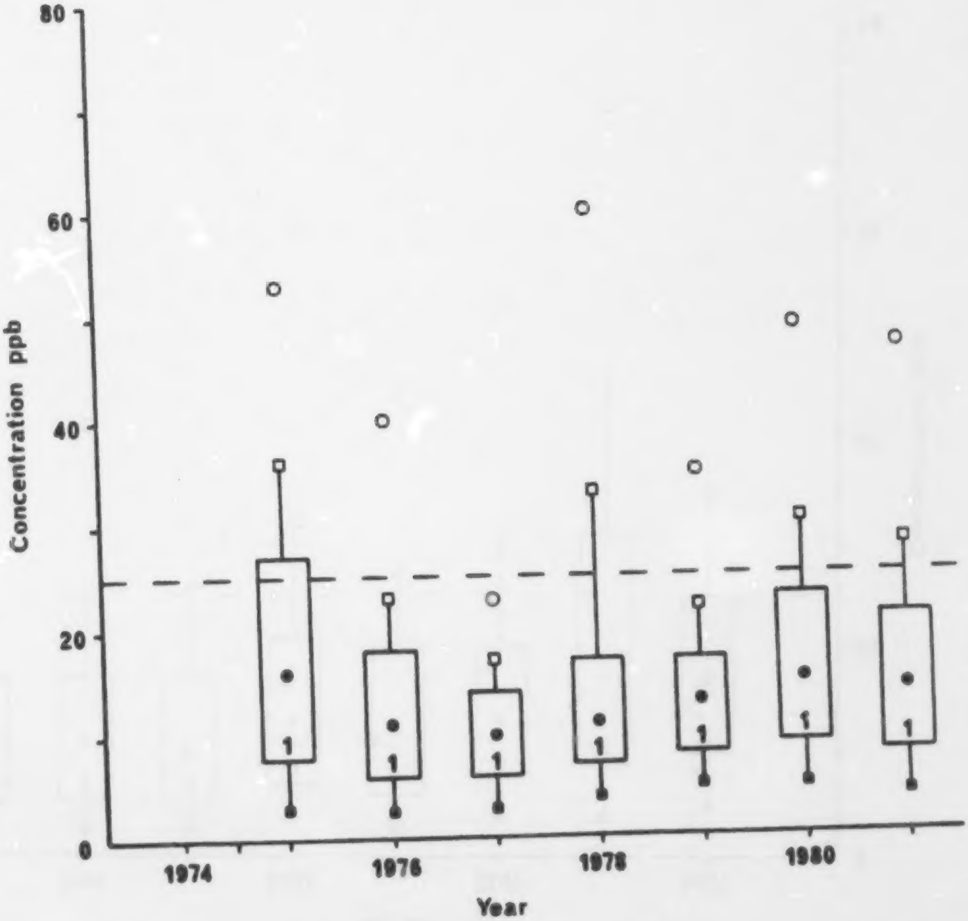
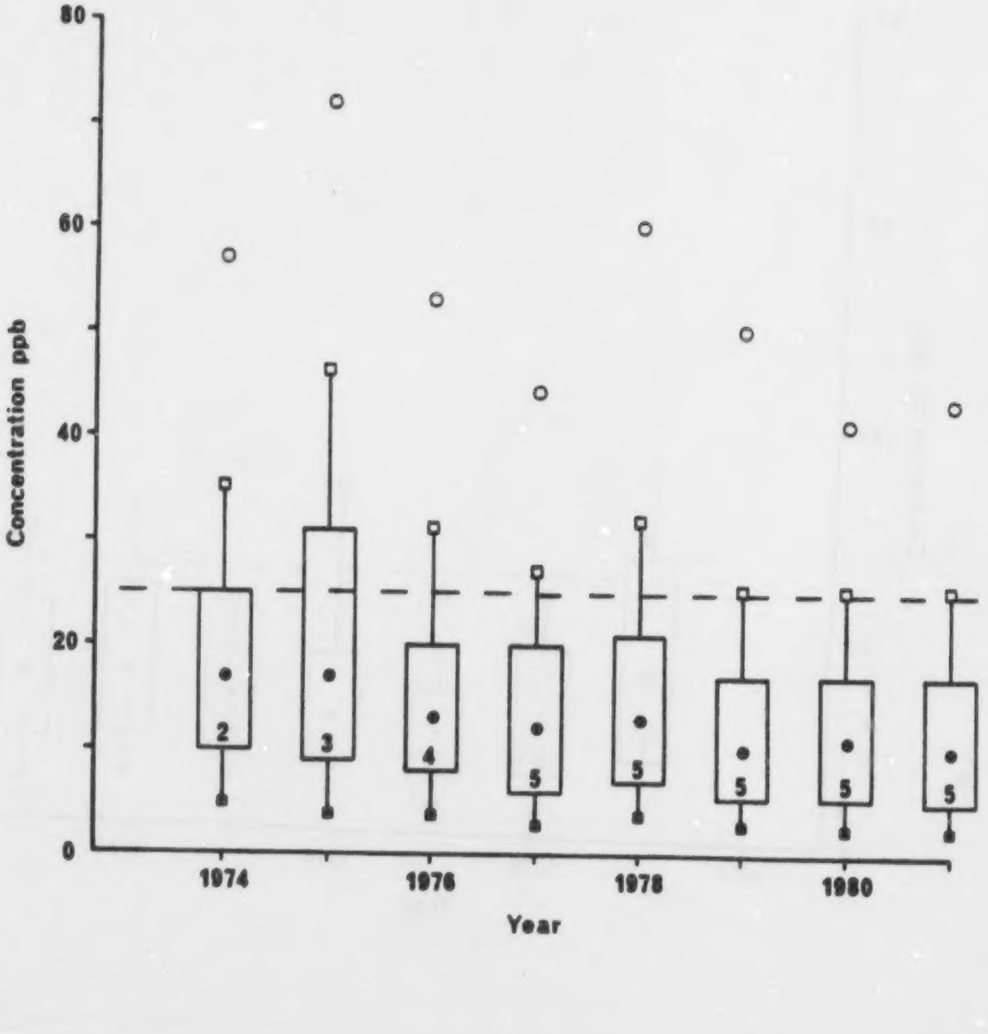


FIGURE 3.4d Toronto; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations



occurring in the summer months. This is consistent with the requirements for ozone formation - clear skies, bright sunshine, warm temperatures and a favouable mix of ozone precursor pollutants. The pattern of higher levels in summer months is exhibited each year and the higher levels in 1974, 1975 and 1978 are notable - probably due to a higher incidence in those years of meteorological conditions conducive to photochemical reactions.

3.2.4 Toronto: Total Hydrocarbons

THC measurements have been available in Toronto since 1971. The composite annual means are illustrated in Figure 3.5a. There has been relatively little variation in the composite annual mean THC levels for all stations and for the nonresidential stations in Toronto. At the single residential station, high levels occurred in 1973 and 1977 (2.8 and 2.45 ppm respectively). However, the data recovery in 1977 (and also 1978) at the residential station was low.

Box plots (Figures 3.5b - 3.5d) indicate the distribution of the 24 hour average THC levels. The 99th percentile levels are typicaly 3.5 ppm and high values occurred in 1971, 1973, 1974 and 1976. These nonresidential stations accounted for the higher (99th and higher) percentiles in 1974 and 1976 (See Figure 3.5d). The residential station recorded high levels for most percentiles especially in 1973.

FIGURE: 3.5a Toronto Stations: Composite Annual Means of the hourly THC Concentrations

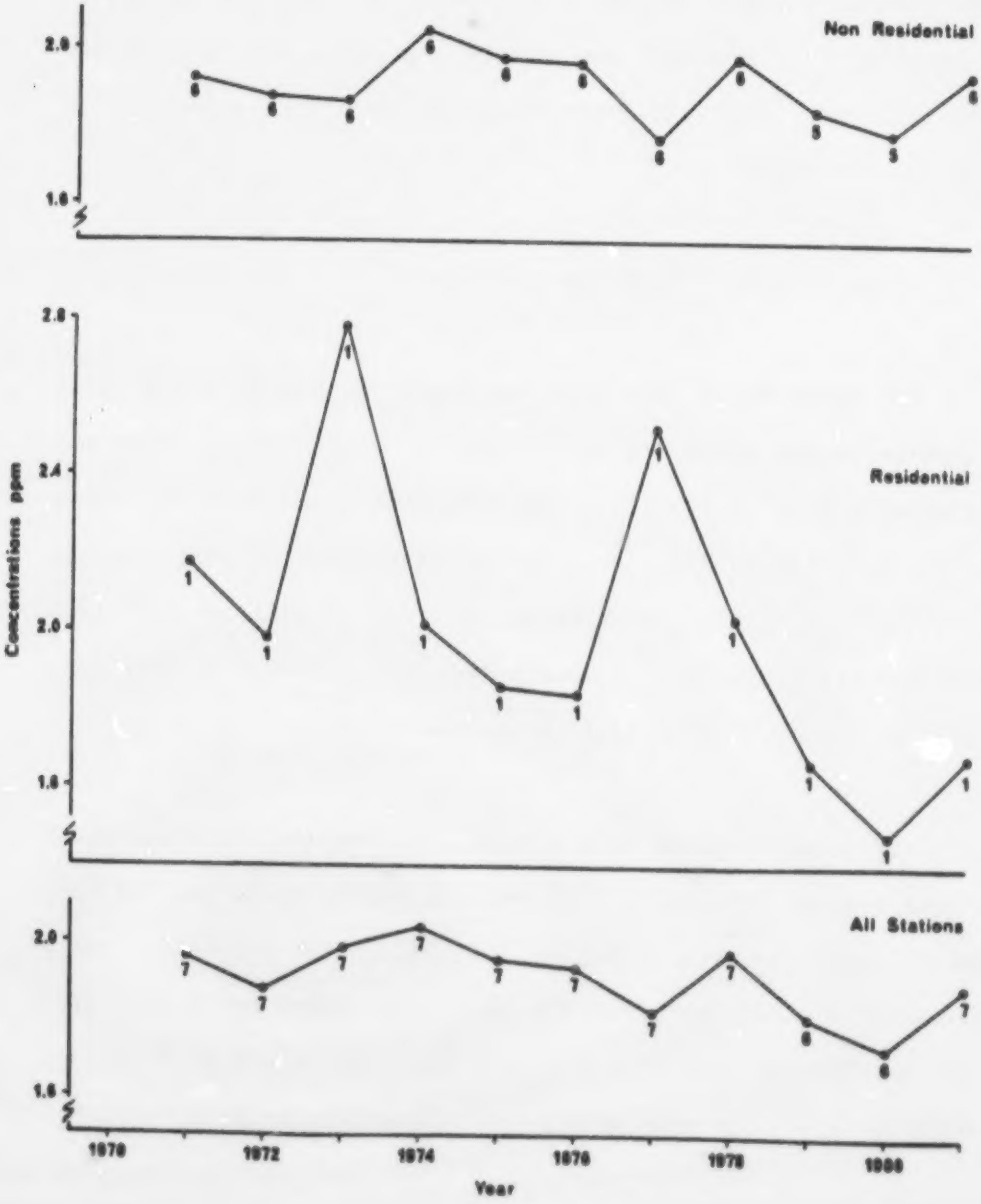


FIGURE 3.5b Toronto; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average THC Concentrations

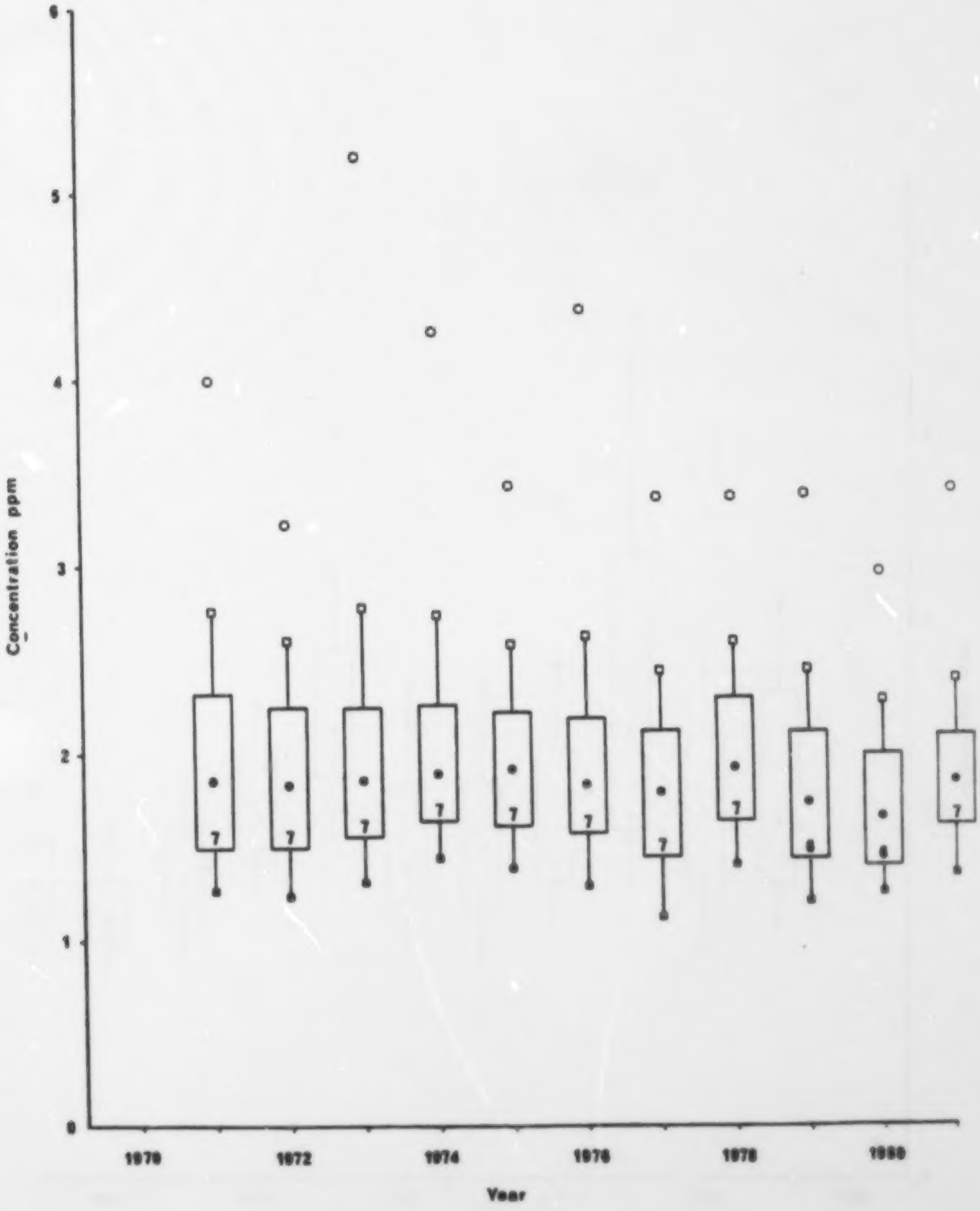


FIGURE: 3.5c Toronto; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average THC Concentrations

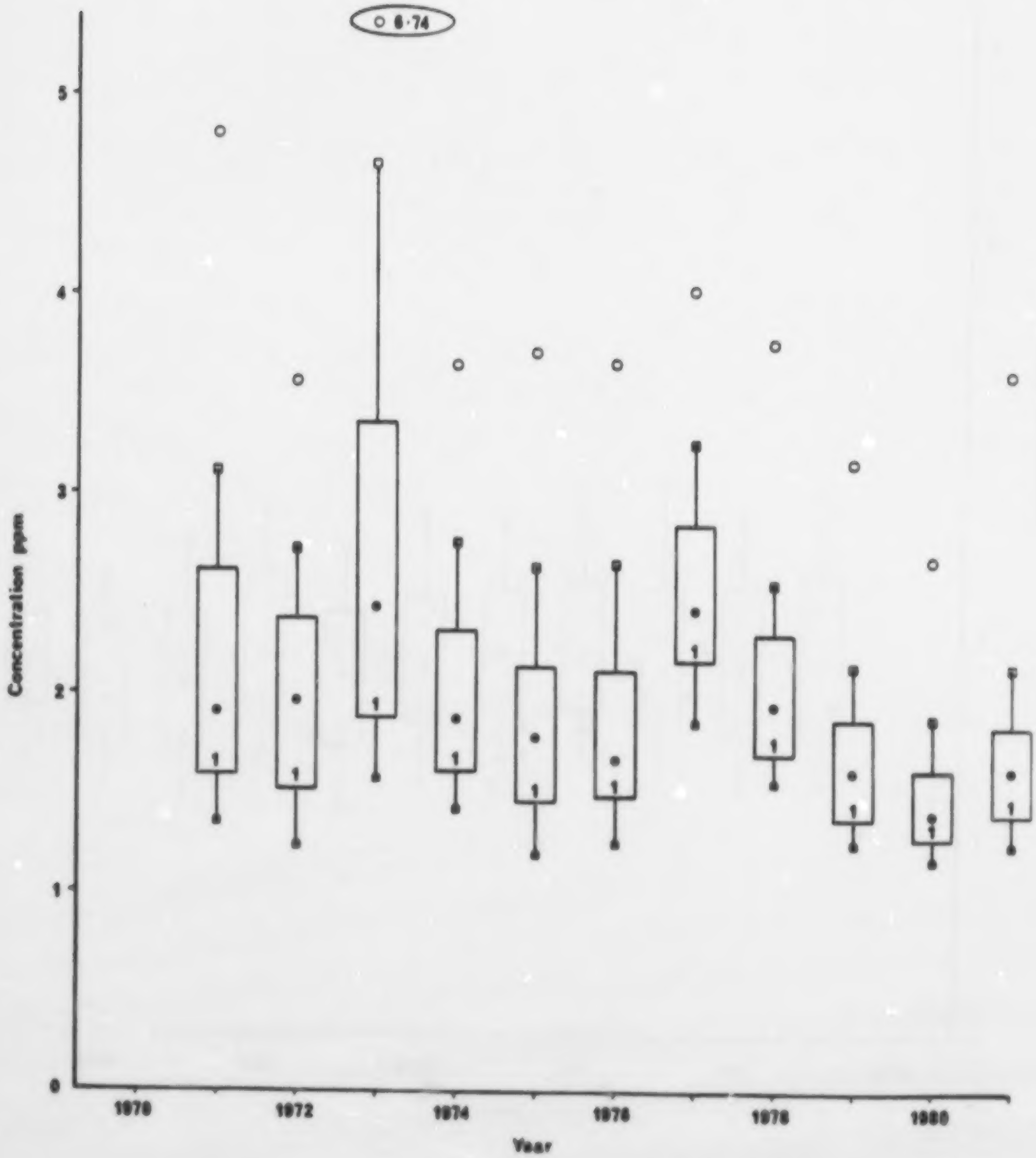
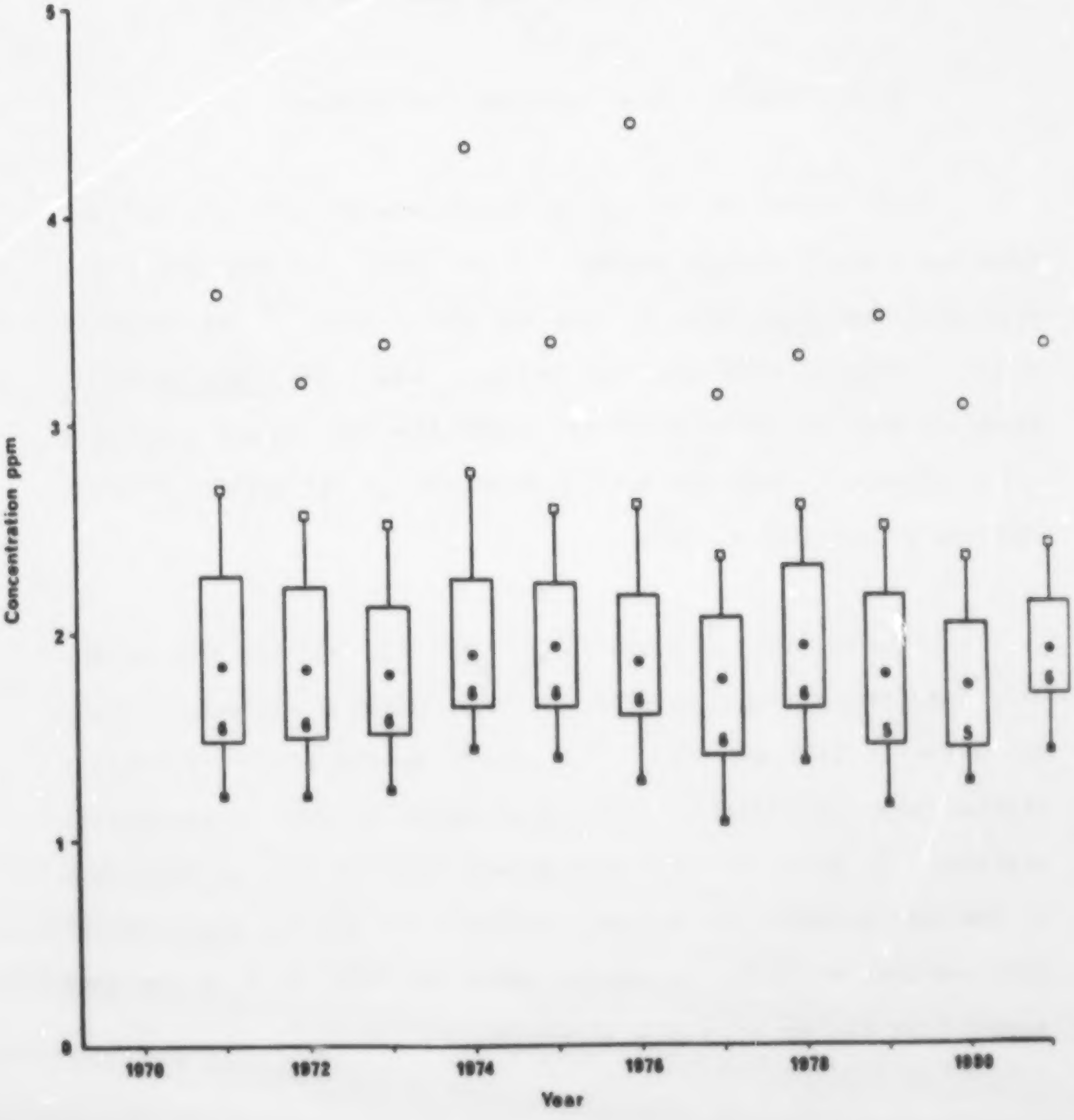


FIGURE: 3.5d Toronto; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average THC Concentrations



It should be noted that there are no federal air quality objectives for total hydrocarbons.

The composite monthly mean THC levels do not show any consistent pattern to indicate strong influences caused by seasonally different emissions or the influence of meteorological factors. Plots of the composite monthly means are given in Appendices F4.1 - F4.3.

3.2.5 Toronto: Total Suspended Particulates

TSP levels in Toronto decreased between 1970 and 1977 but there was a small increase between 1978 and 1980. The 1981 levels however were lower than those in 1979 and 1980. Plots of the composite annual (geometric) means are given in Figure 3.6a. The composite annual geometric mean for all stations was higher than the maximum acceptable annual (geometric) mean air quality objective for TSP between 1970 and 1974 and also in 1976 and 1978.

The box plots (Figures 3.6b - 3.6d) show that the 99th percentile level remained fairly constant at about 220 $\mu g\ m^{-3}$ except for higher levels in 1970 and 1973. TSP levels at the single residential station were consistently lower than those at the nonresidential stations. It should be noted that between 1970 and 1973 at least 25 % of the data exceeded the maximum acceptable air quality objective (24 hour average) while for subsequent years, at least 10 % of the data exceeded the maximum acceptable objective.

FIGURE: 3.6a Toronto Stations: Composite Annual Means of the 24 hour Average TSP Concentrations

Dashed line indicates the National maximum acceptable air quality objective level for the annual geometric mean TSP concentration.

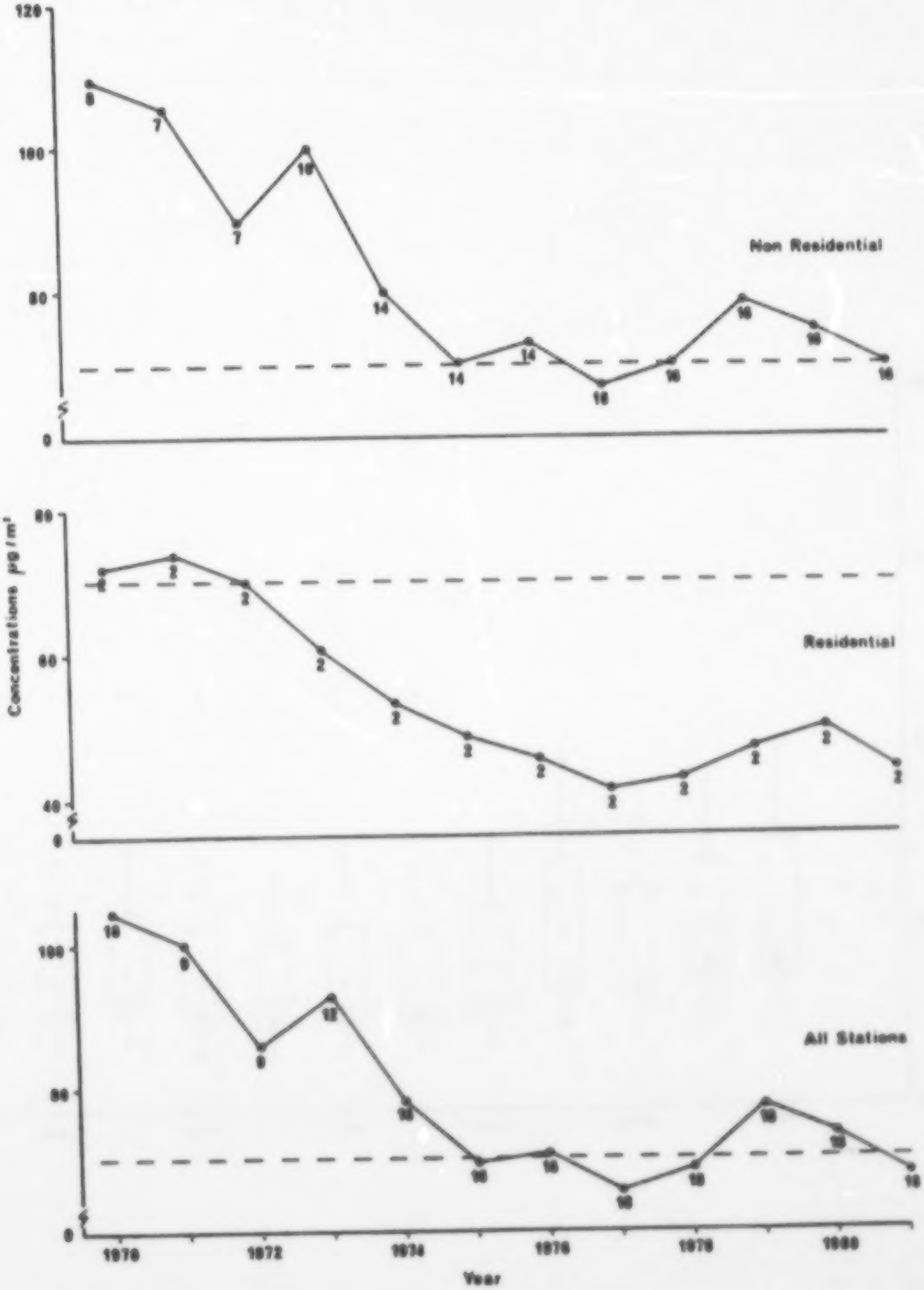


FIGURE: 3.6b Toronto; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations

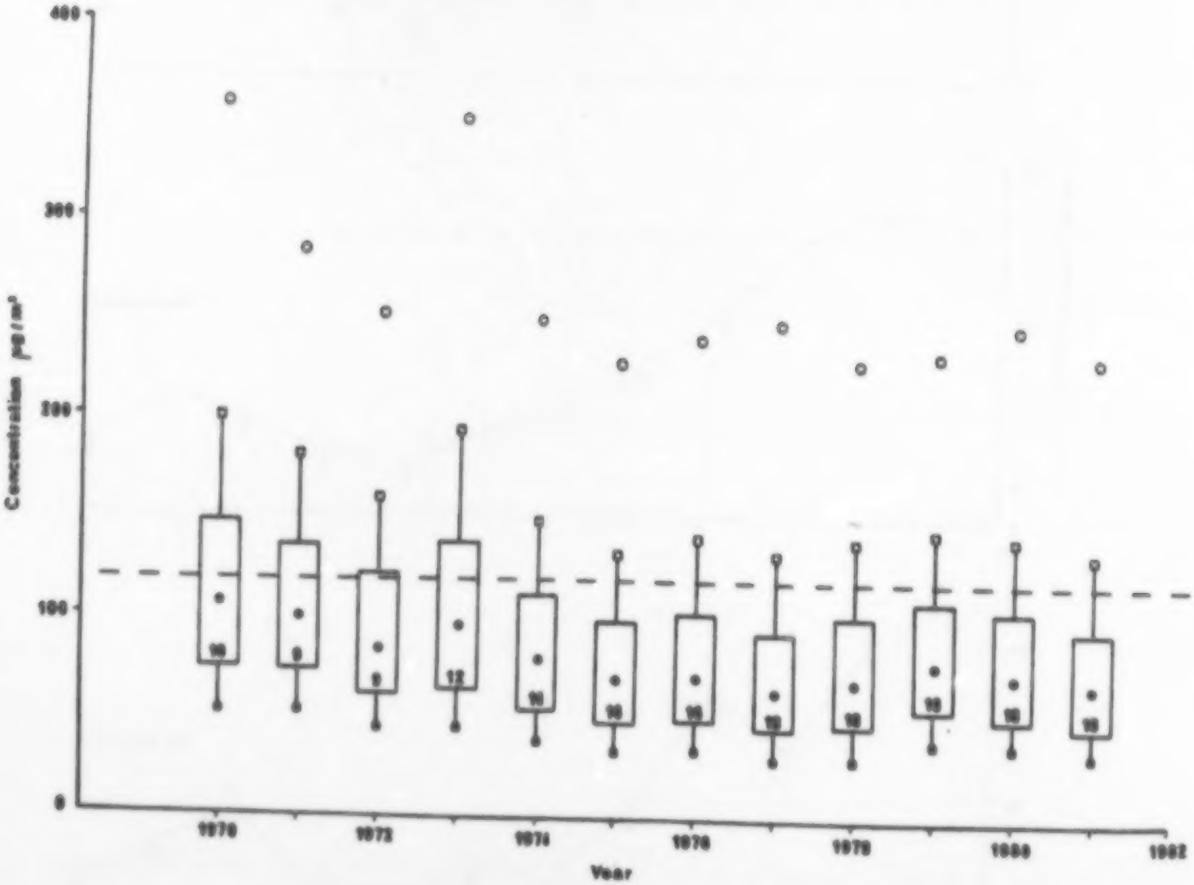


FIGURE: 3.6c Toronto; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations

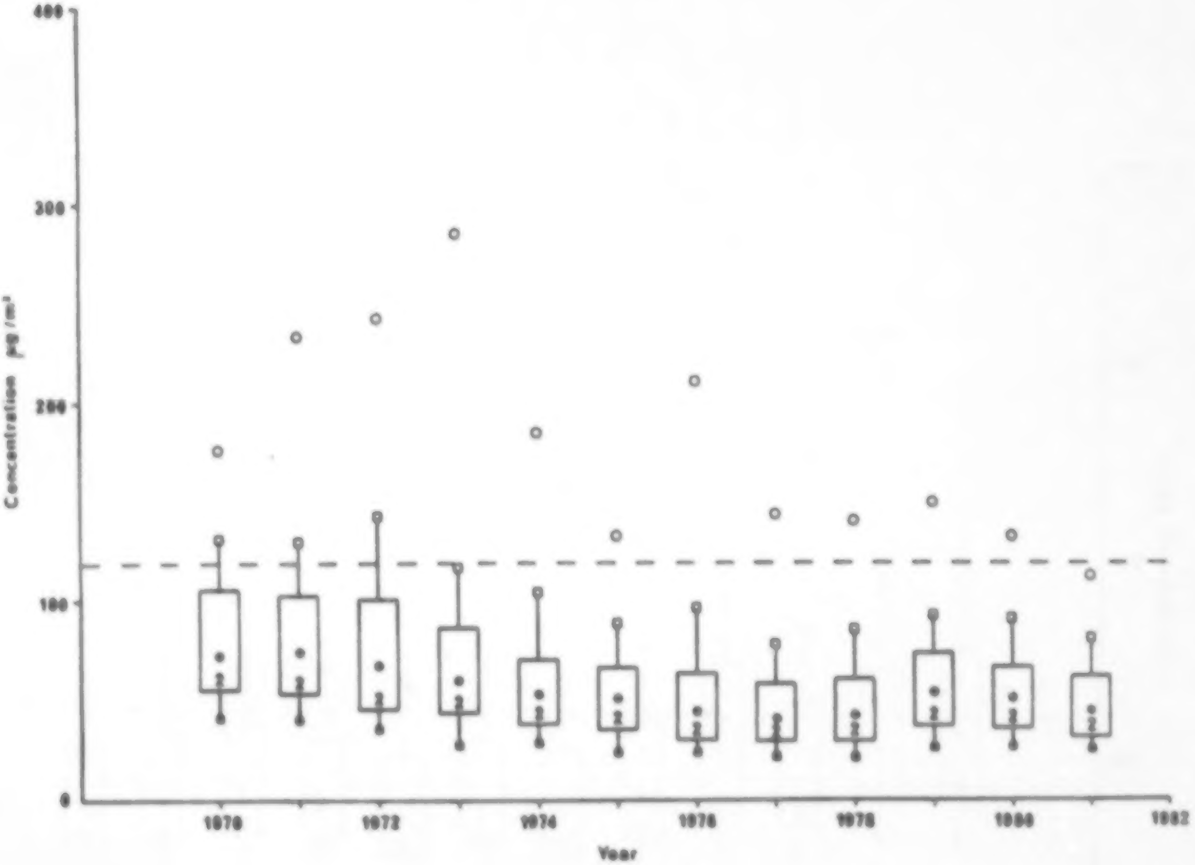
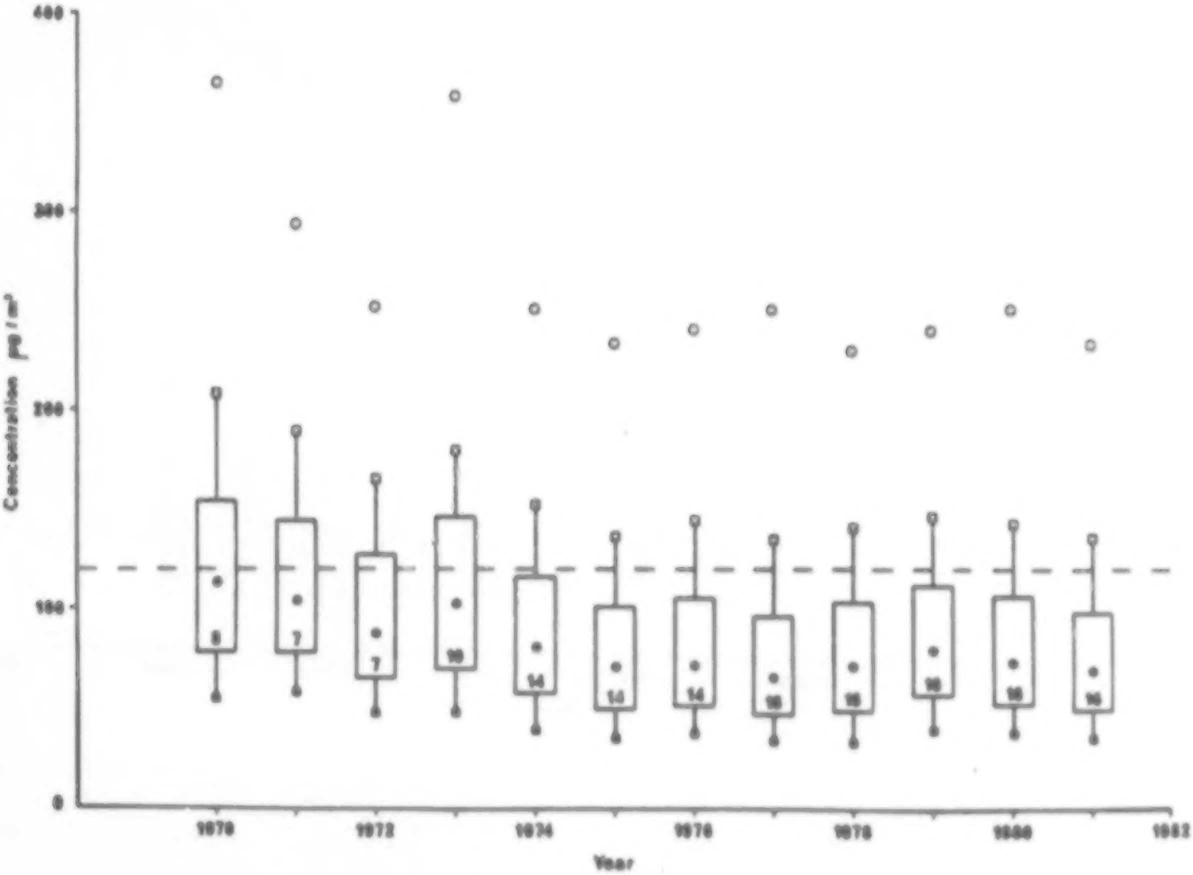


FIGURE: 3.6d Toronto; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations



The TSP levels are usually highest in May and June and lowest in the colder months. The snow cover in the colder months will greatly reduce TSP levels due to reduced reentrainment of soil or roadway generated particulates. Plots of the composite monthly mean TSP levels for the three groupings of stations are presented in Appendices F5.1 - F5.3.

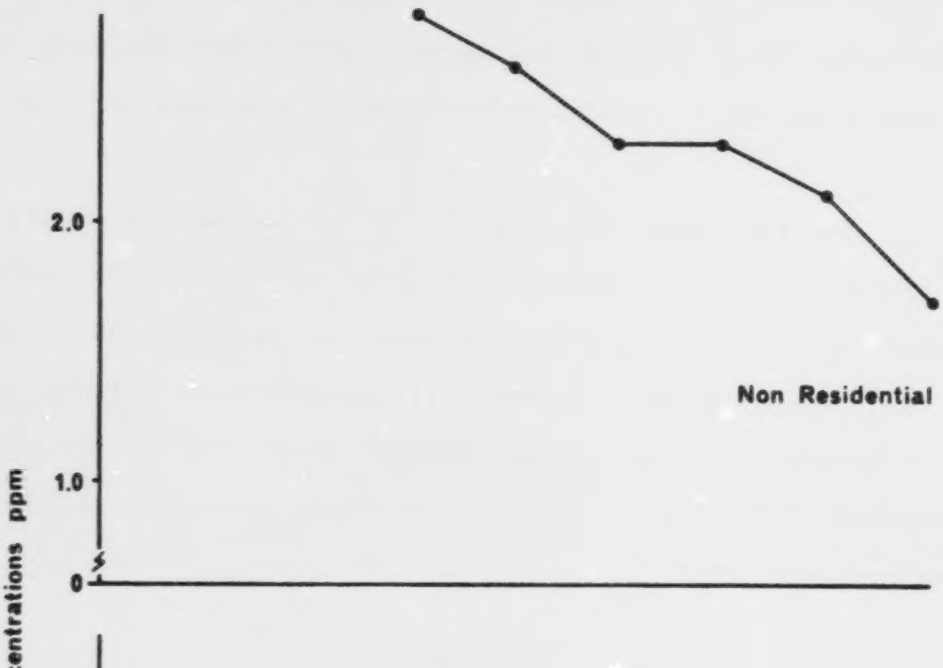
The air quality objective for TSP defines maximum acceptable and tolerable levels averaged over 24 hours and 1 year. The maximum tolerable objective averaged over 24 hours was exceeded most in 1973 (7) from twelve stations. Between 1977 and 1981 there were between 1 and 3 exceedances of the maximum tolerable level (from 18 stations). Tabulations of the exceedances of the air quality objectives for TSP are given in Appendix B5.3.

3.3 Air Quality Trends: Montreal

3.3.1 Montreal: Carbon Monoxide

The composite (all stations) annual mean CO level in Montreal between 1976 and 1981 varied between 1.6 and 2.0 ppm with a general trend to lower levels in later years. The composite annual mean for residential stations has been fairly constant since 1976. In the case of the nonresidential stations, the composite annual means have been higher than those for the residential stations from 1976 even though the composite annual mean for nonresidential stations has been decreasing since 1976. Figure 3.7a illustrates plots of the composite annual means for CO concentrations in Montreal.

FIGURE 3.7a Montreal; All Stations: Composite Annual Means of the hourly CO Concentrations.



The box plots for each of the grouping of stations (Figures 3.7b - 3.7d) show patterns similar to the composite annual means. These patterns are consistent with the groupings of the stations and indicate the stronger influence of automobile sources of CO at the nonresidential stations.

The composite monthly means for CO levels in Montreal (all stations) show a pattern in which highest levels occur in the colder months December, January and February and lower levels tend to occur between May and July. (See Appendices C1.1-C1.3, and G1.1-G1.3). This pattern is also shown for the residential stations. In the case of nonresidential stations, there was a departure from this pattern especially in 1976 and 1977 when relatively high levels occurred in the warmer months.

The maximum acceptable CO level averaged over 1 hour (31 ppm) was exceeded once in 1978. Appendix C1.3 lists exceedances of the maximum desirable and acceptable CO levels averaged over 1 hour.

3.3.2 Montreal: Nitrogen Dioxide

Four years data for NO_2 are available in Montreal and in this relatively limited period, the composite annual means generally decreased. The composite annual mean (all stations) decreased from 30.6 ppb in

FIGURE: 3.7b Montreal; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations

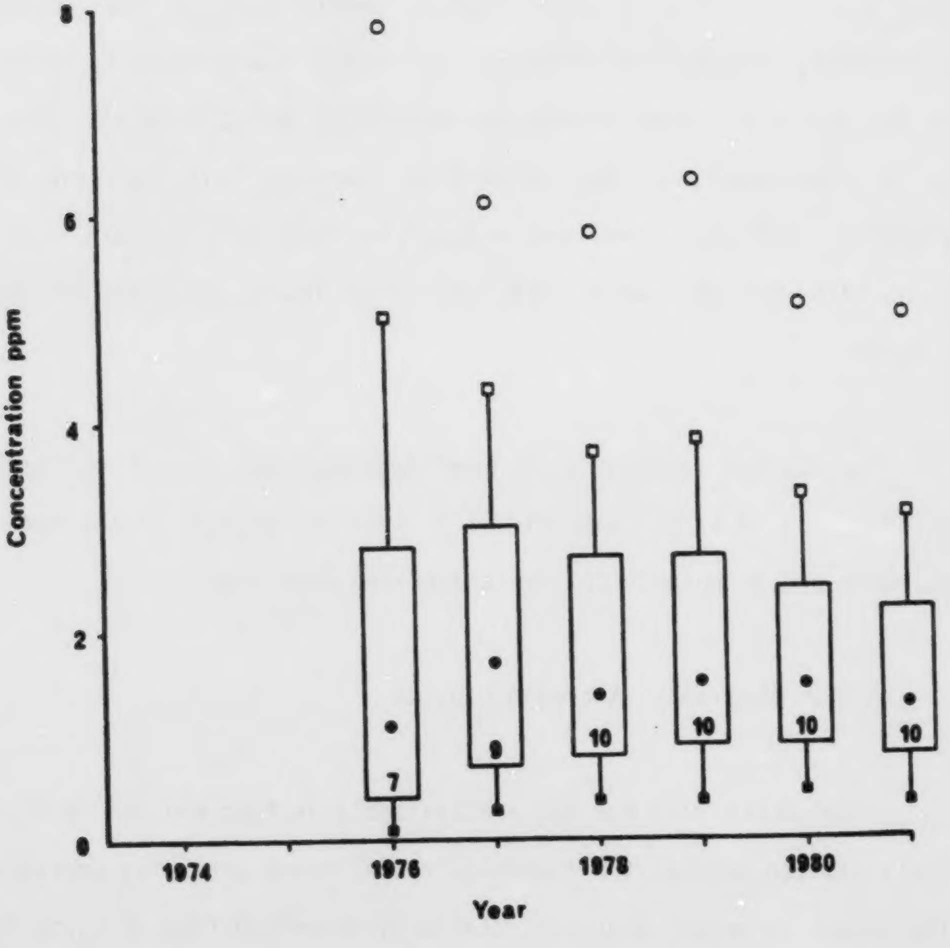


FIGURE 3.7c Montreal; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations

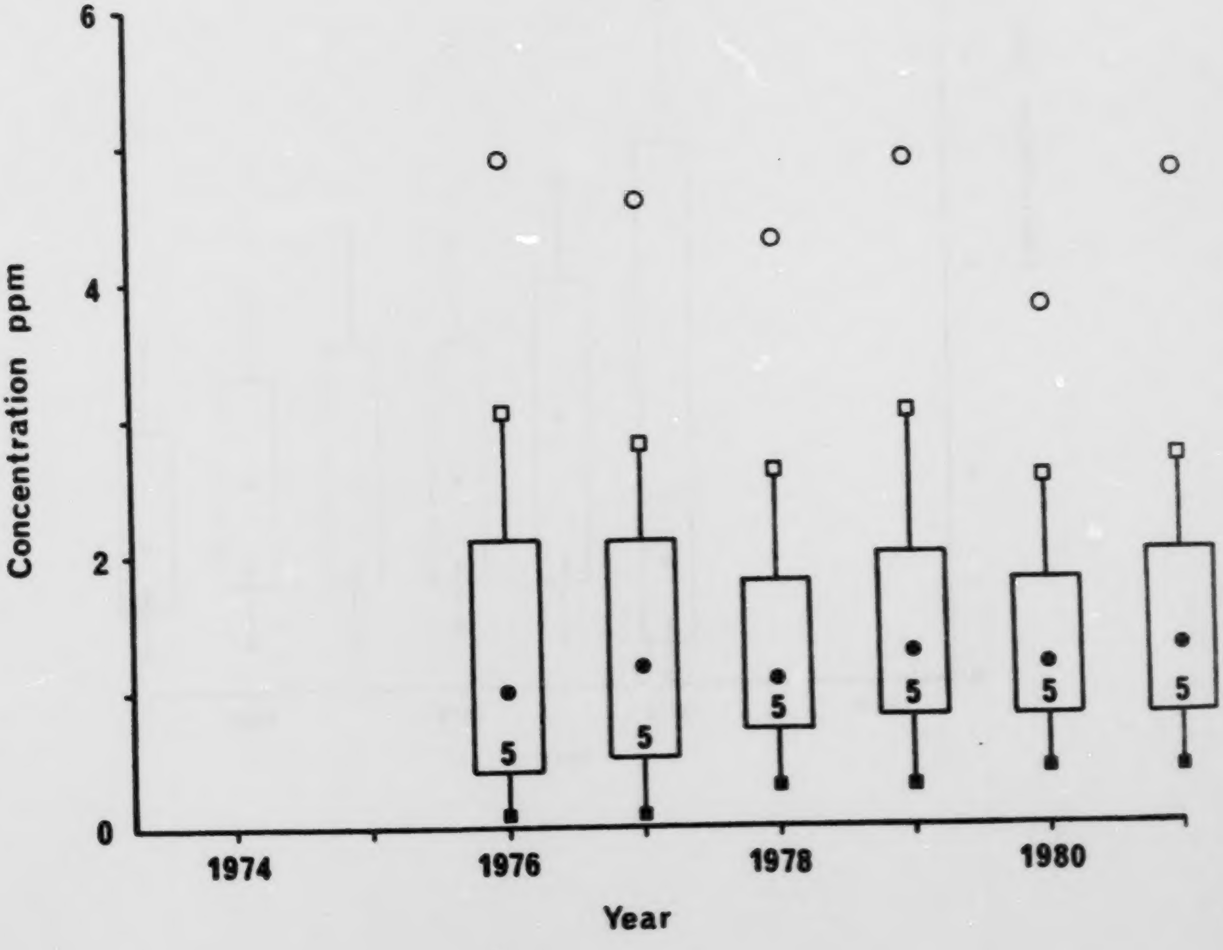
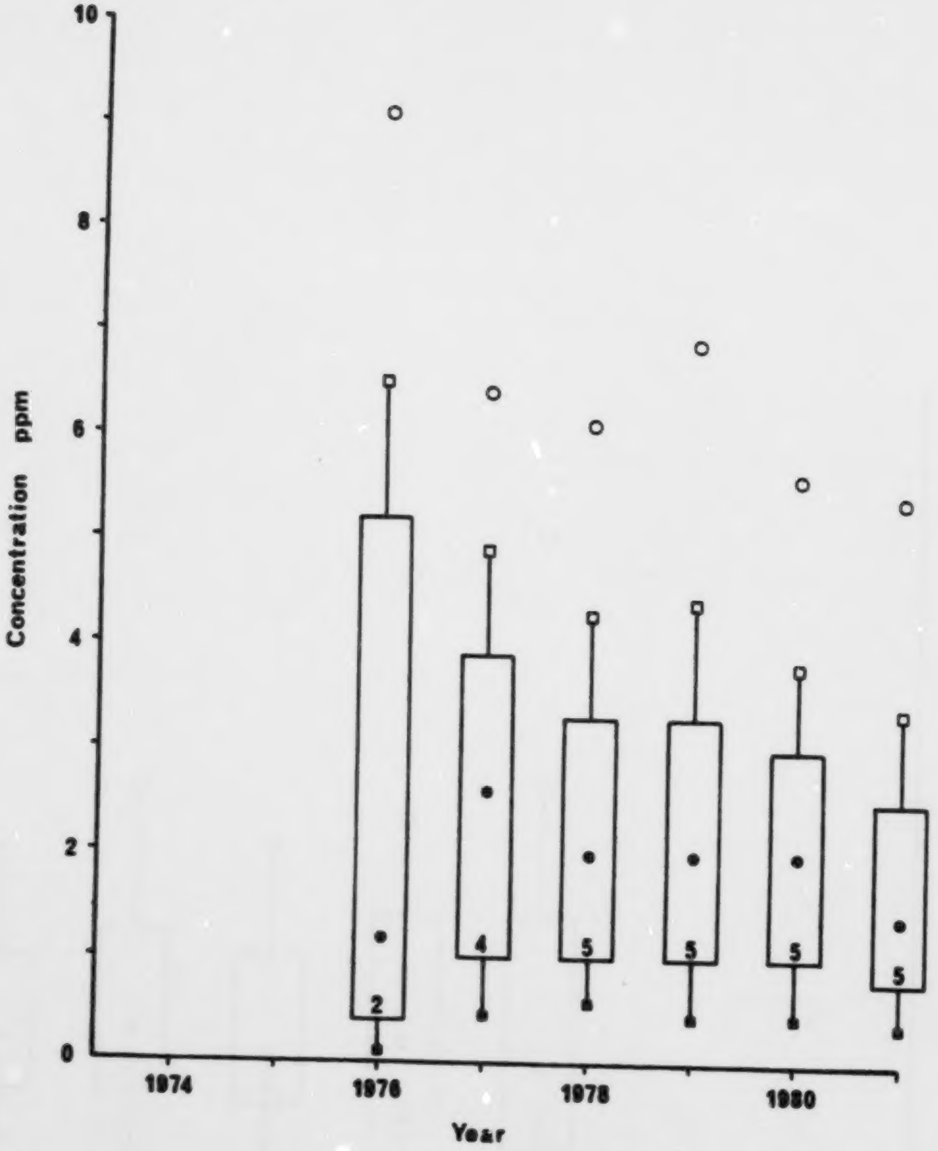


FIGURE 3.7d Montreal; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations



1979 to 23.2 ppb in 1982. The decrease was more pronounced at the non-residential stations than at the residential stations. See Figure 3.8a.

The box plots for each of the station groupings are shown in Figures 3.8b.-3.8d. The 75th and lower percentiles showed patterns similar to the annual means (generally decreasing levels) but for the 90th and 99th percentiles, more varied behaviour occurred.

The maximum acceptable NO_2 air quality objective (210 ppb) averaged over 1 hour was exceeded in Montreal eleven times in 1982 and five times in 1981. At no time between 1979 and 1982 was the maximum tolerable level (530 ppb) averaged over 1 hour, exceeded. The maximum desirable and maximum acceptable air quality objectives for NO_2 (110 ppb and 160 ppb respectively) averaged over 24 hours, were exceeded only in 1982 (five times for the maximum desirable level and once for the maximum acceptable 24 hour average).

The composite monthly means (see Appendices G2.1- G2.3) are generally higher in the cooler months than in the warmer months. This is the pattern expected on the basis of lower mixing heights in winter months but in the absence of detailed meteorological data analysis, this remains a speculative explanation.

Figure 3.8a Montreal Stations: Composite Annual Means of the hourly NO_2 Concentrations

Dashed line indicates the National maximum acceptable air quality objective level for the annual arithmetic mean NO_2 concentration.

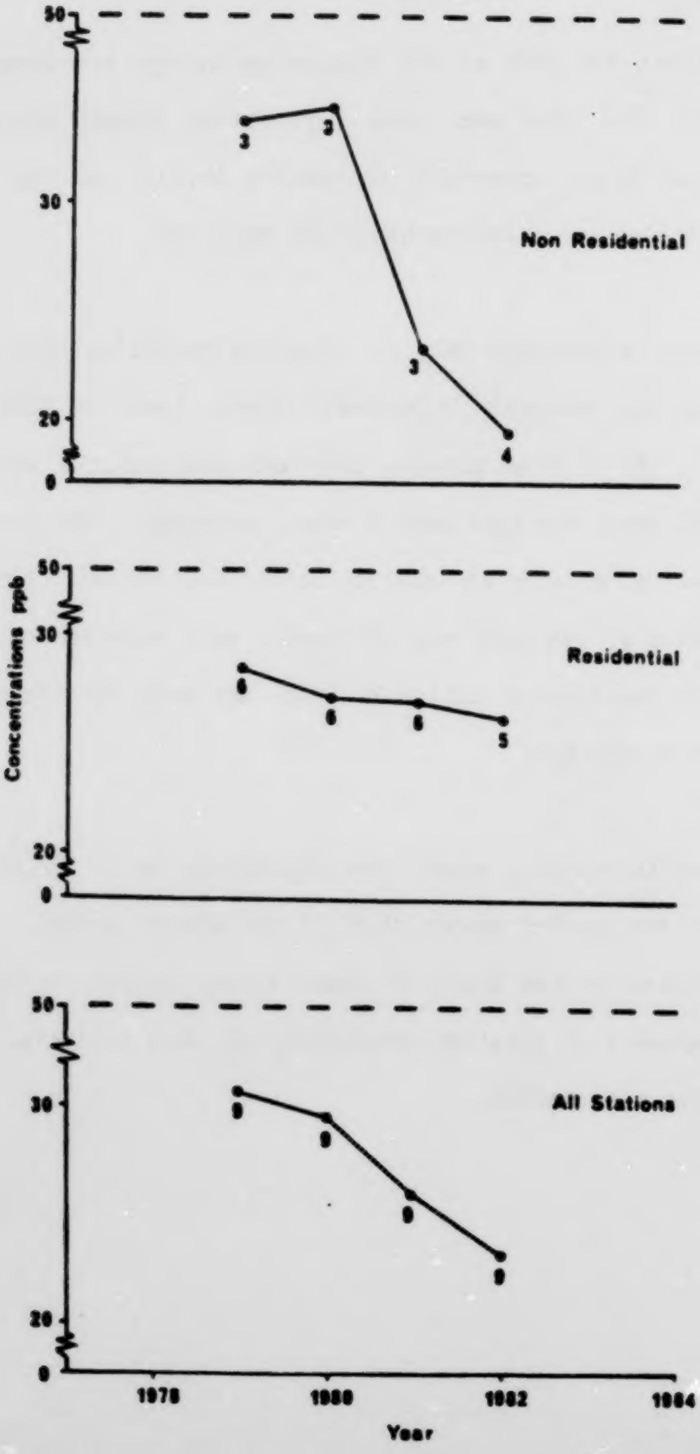


FIGURE 3.8b Montreal; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations

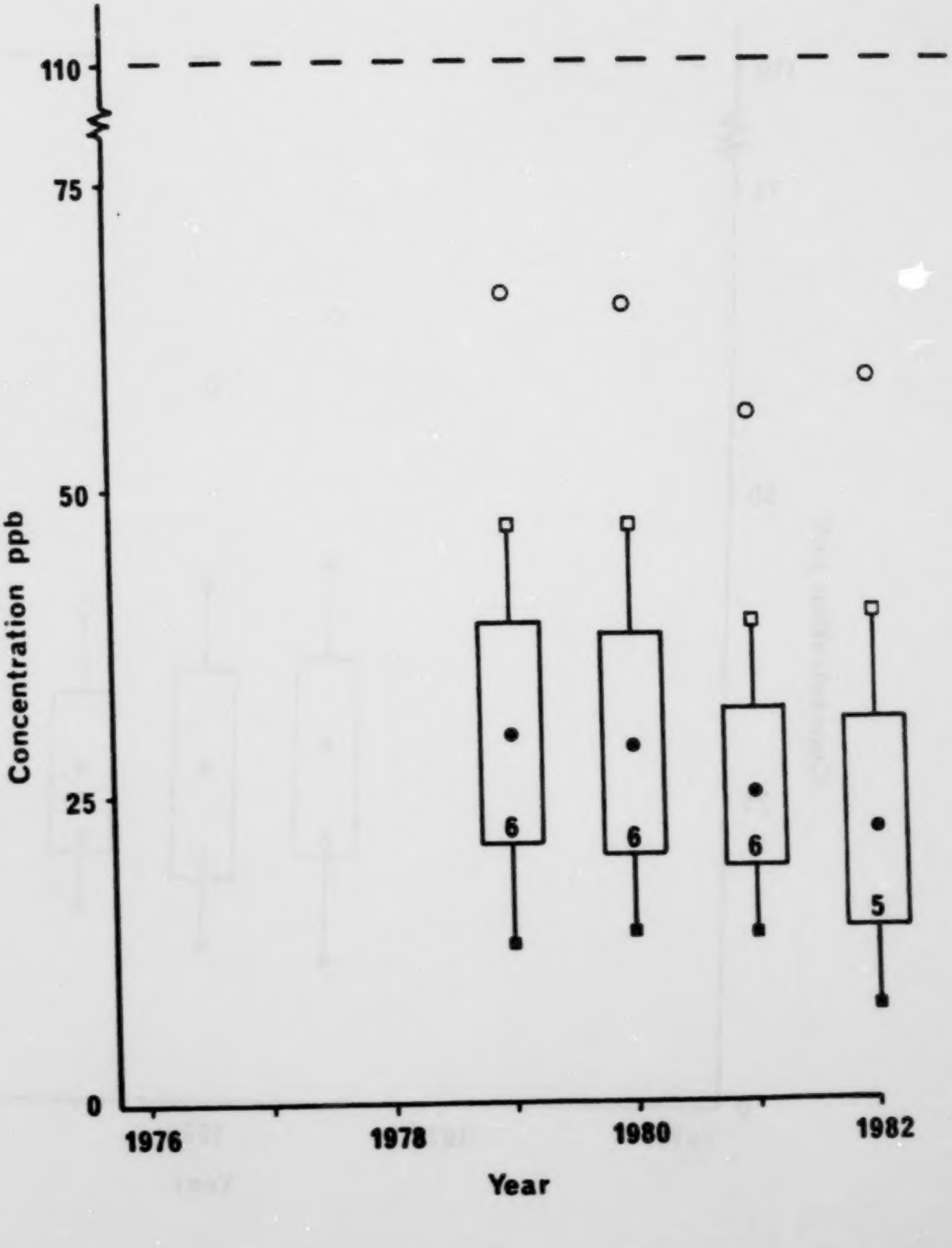


FIGURE: 3.8c Montreal; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations

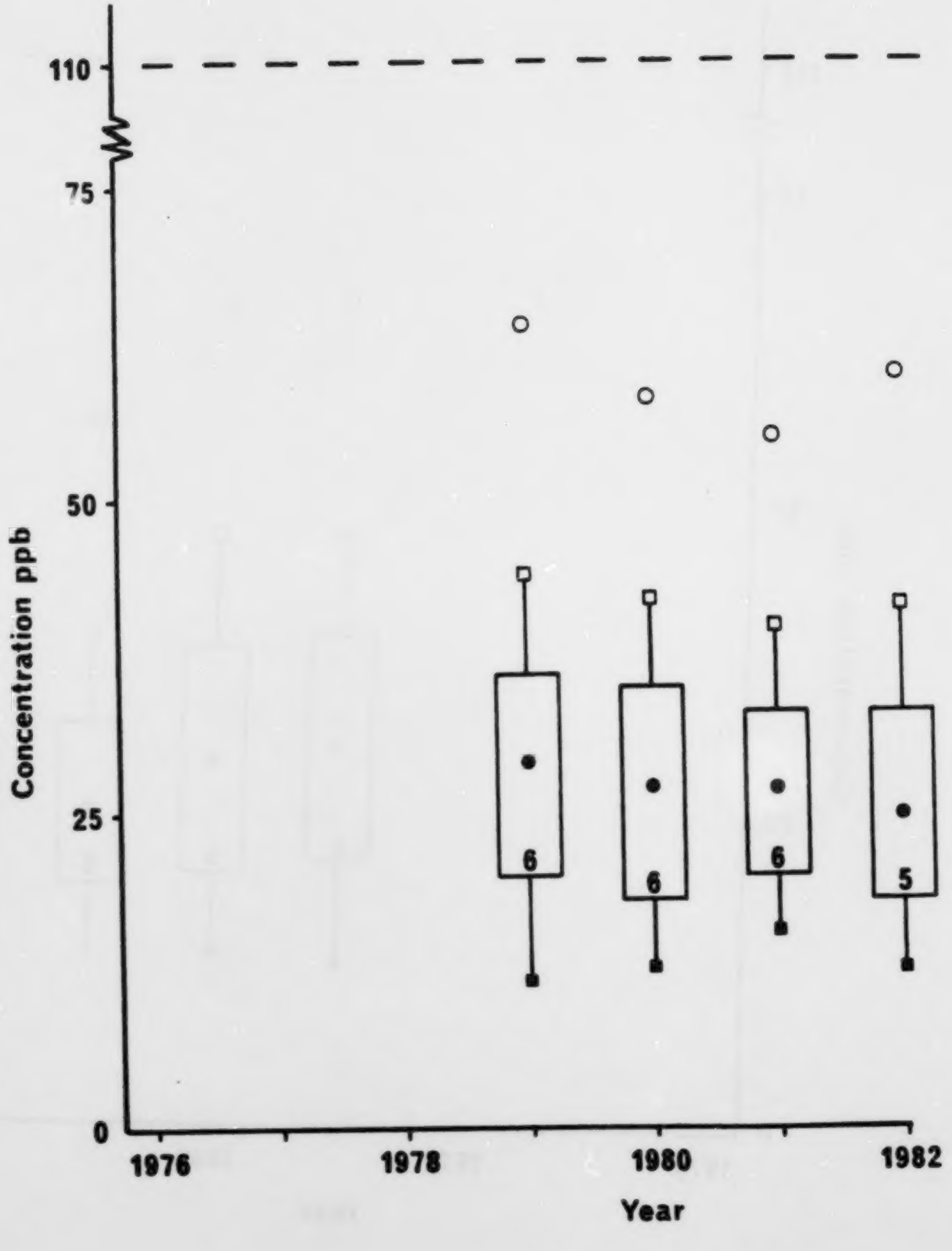
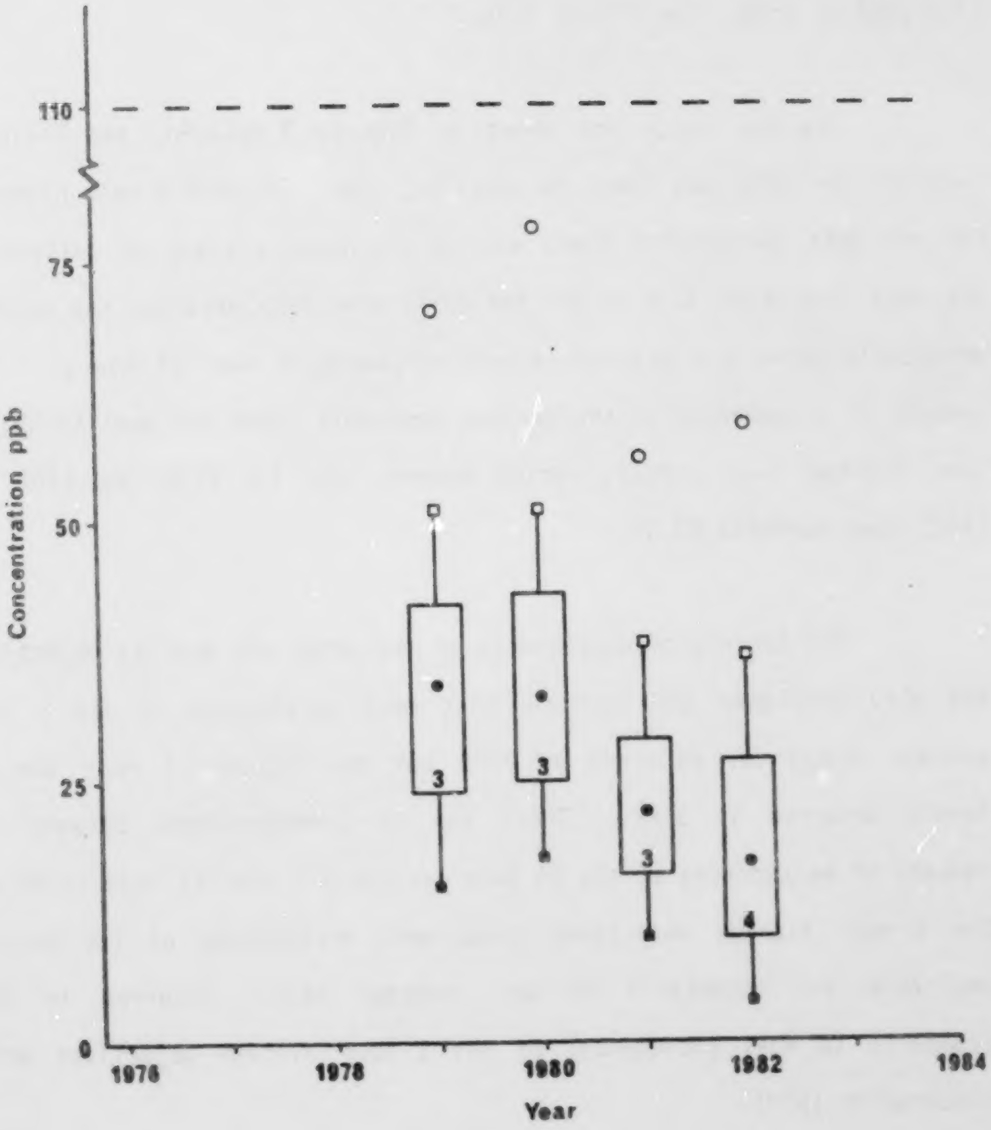


FIGURE: 3.8d Montreal; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations



3.3.3 Montreal: Ozone

Over the four year period (1979 to 1982) for which ozone data were available, the composite annual means decreased slightly (by ~ 2ppb) in the first three years but there was a relatively large increase (3-5 ppb) in 1982. See Figure 3.9a.

The box plots are shown in Figures 3.9b-3.9d, and indicate that for the 90th and lower percentiles, the 1979 levels were highest. For the 99th percentiles there was no discernible trend or pattern in the data. At least 10 % of all the daily mean data exceeded the maximum acceptable ozone air quality objective (averaged over 24 hours). The numbers of exceedances of the maximum desirable ozone air quality objective averaged over 1 hour, varied between 1909 (in 1979) and 1109 (in 1982) (See Appendix C3.3).

The numbers of exceedances of the other air quality objectives are also tabulated and indicate that most exceedances of the 1 hour average objectives occurred in 1979 but the highest 1 hour average levels occurred in 1982. There was no correspondence between the numbers of exceedances of the 24 hour average air quality objectives and the 1 hour average objectives since most exceedances of the maximum desirable and acceptable 24 hour average levels occurred in 1982 (compared to most exceedances of the 1 hour average objectives which occurred in 1979).

FIGURE 3.9a Montreal Stations: Composite Annual Means of the hourly O_3 Concentrations.

Dashed line indicates the National maximum acceptable air quality objective level for the annual arithmetic mean O_3 concentration.

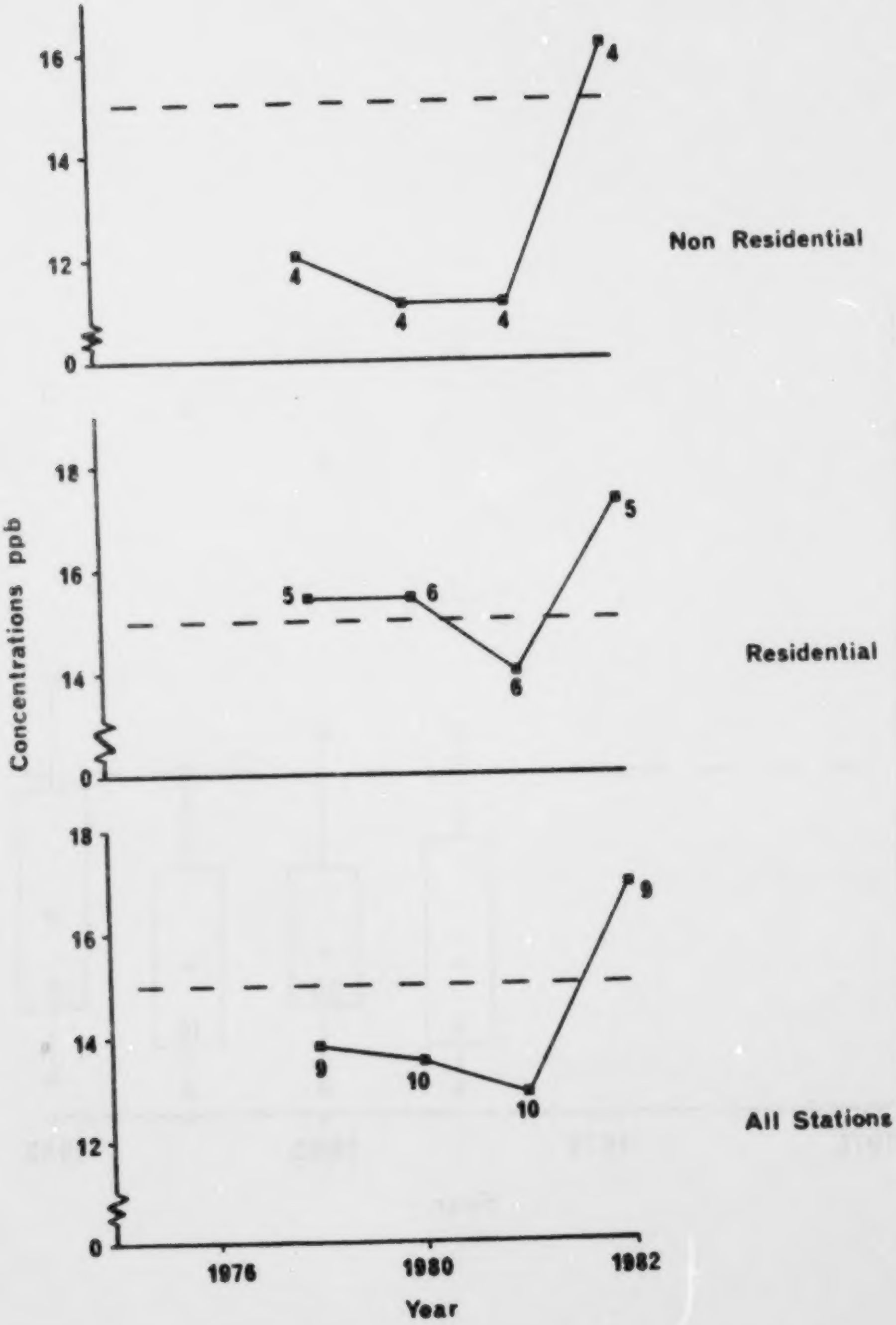


FIGURE: 3.9b Montreal; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations

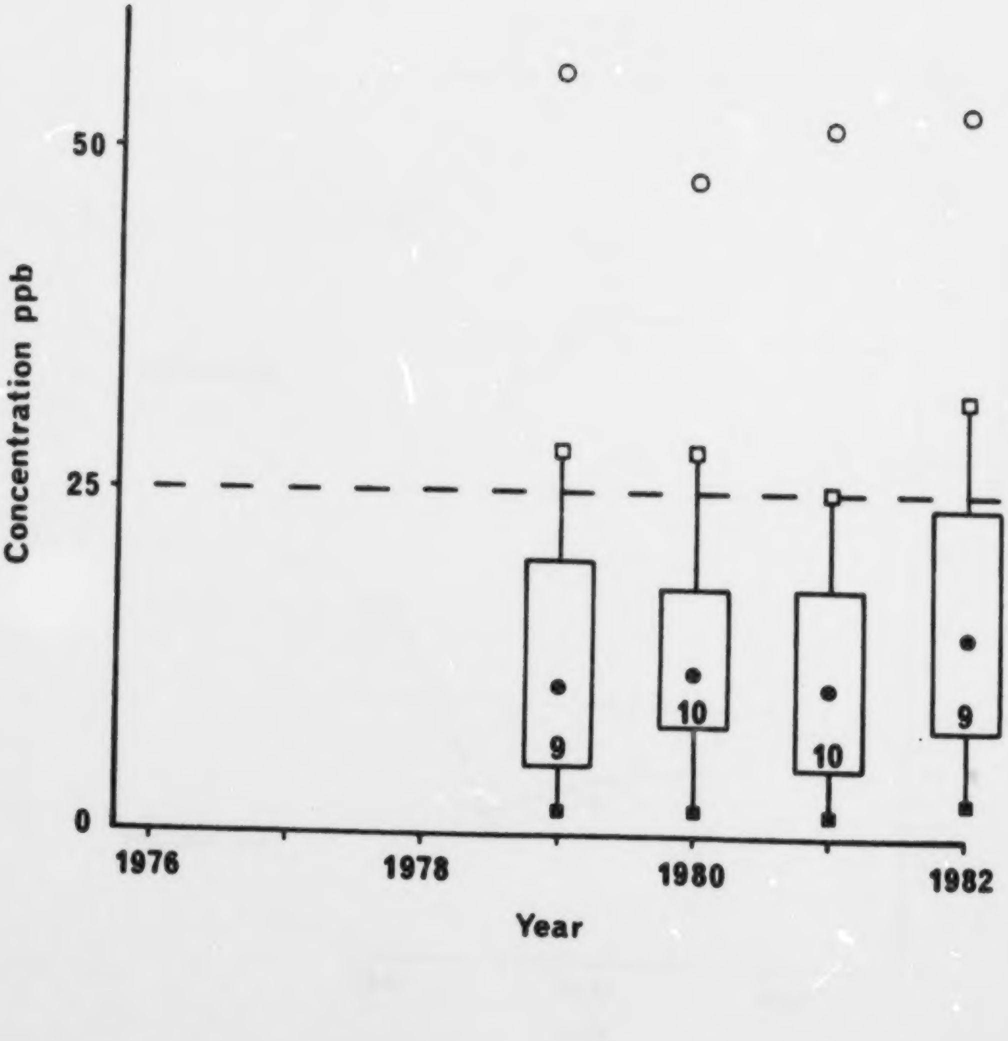


FIGURE: 3.9c Montreal; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations

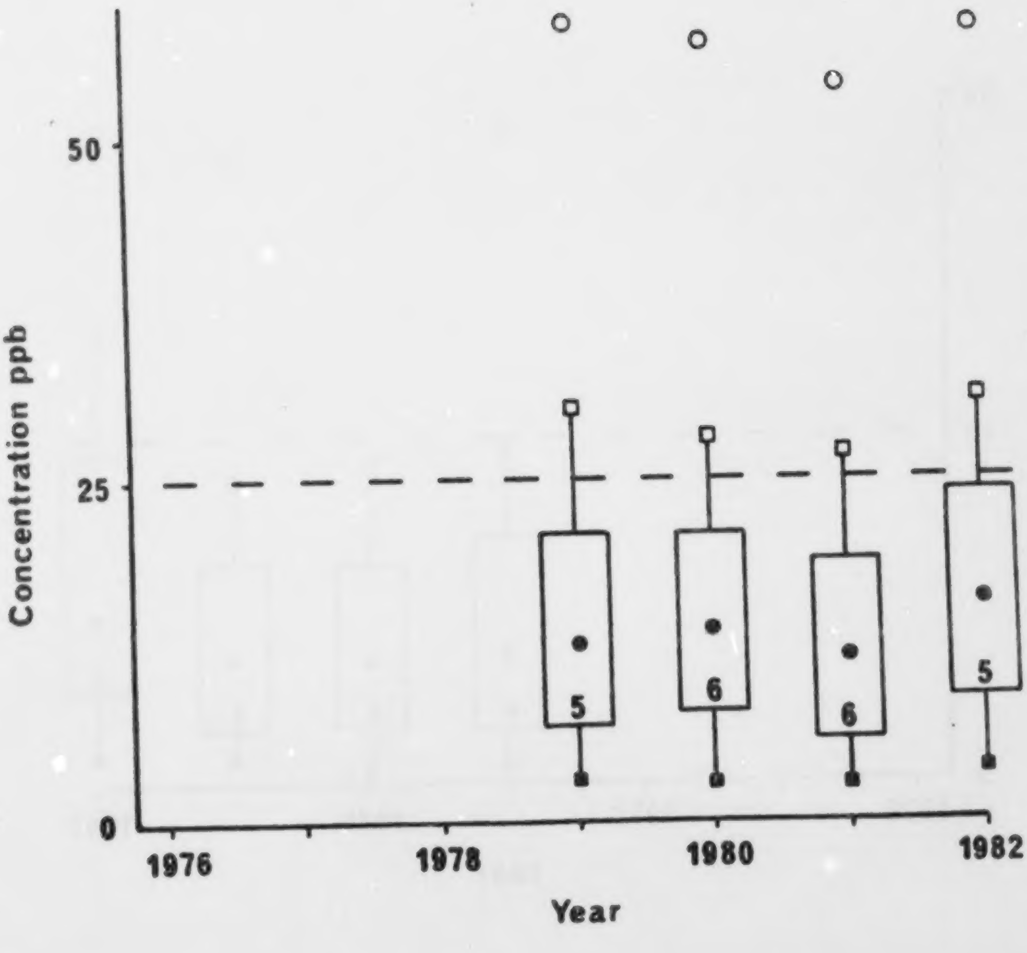
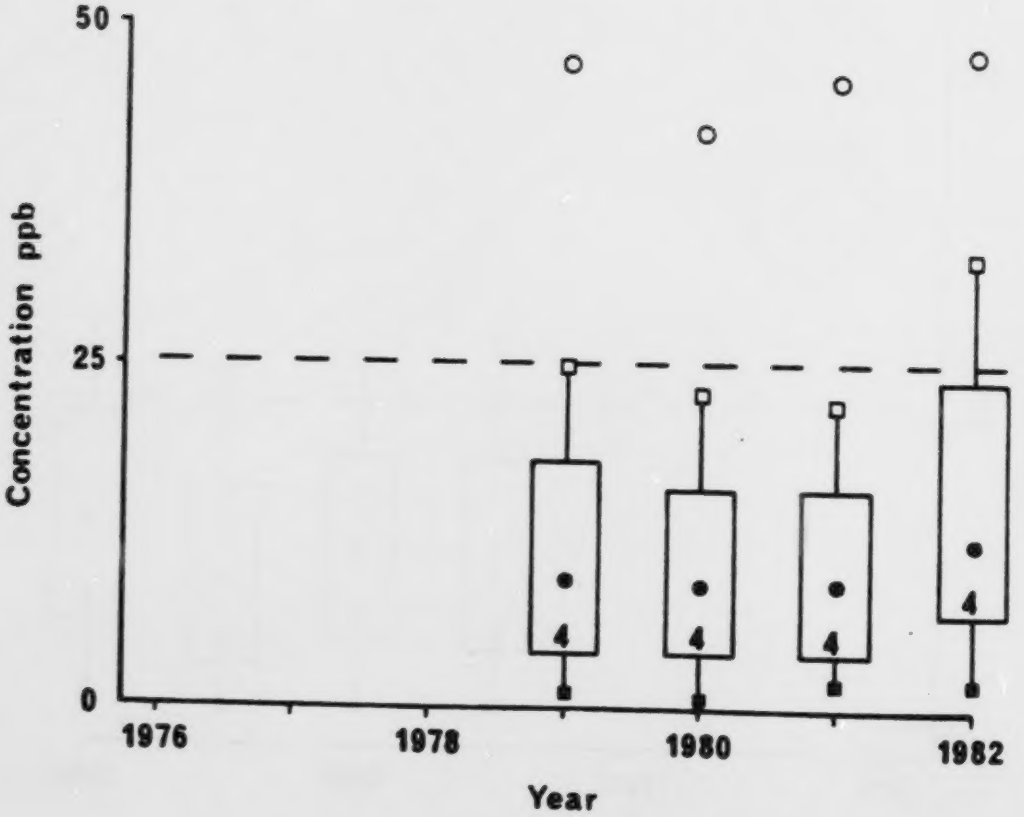


FIGURE 3.9d Montreal; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations



The composite monthly mean ozone levels show that highest levels occur between April and July. Oxidant studies (Concord Scientific Corporation 1983) showed that episodes ($[O_3] > 82$ ppb for 3 or more consecutive hours) occurred most frequently in the months of June or July. This pattern is consistent with the requirement of bright sunshine and favourable meteorological conditions.

The relatively high mean levels of ozone in April and May are similar to those found in other areas and probably is more indicative of ozone from natural rather than anthropogenic sources. The typical variation of the natural troposphoric ozone levels on an annual basis have been estimated to have peak levels in the early spring (peak levels (50-80 ppb) with minimum levels in the late fall or early winter) (Singh et al. 1978.) Plots of the composite monthly mean ozone concentrations in Montreal are given in Appendices G3.1-G3.3.

3.3.4 Montreal: Total Hydrocarbons

There were insufficient data available for THC in Montreal for any trend analysis to be done.

3.3.5 Montreal: Total Suspended Particulates

The TSP levels at Montreal stations were highest in 1974, but in later years the levels decreased and have remained fairly constant since 1977. This pattern is similar for all groupings of stations as is illustrated in Figure 3.10a. The TSP levels (composite annual geometric means) for the nonresidential stations were higher than those for the residential stations.

The distributions of the daily means each year are illustrated in the box plots for the three groupings of stations (Figures 3.10b-3.10d). Since 1978, the concentrations corresponding to the 75th, 90th and 95th percentiles for the nonresidential stations have tended to increase in contrast to a general decreasing trend (for the same time period) at the residential stations. Extremely high levels for the 99th percentile occurred in 1977 and 1974.

The maximum acceptable 24 hour average TSP air quality objective has been regularly exceeded at Montreal stations but the number of exceedances (on a per station basis) has been decreasing with most decreases occurring at the residential stations (See Appendix C4.3). The maximum acceptable 24 hour average TSP air quality objective was exceeded five times in 1974 and three times in 1977. In all other years there was either one or no exceedance of this air quality objective.

FIGURE: 3.10a Montreal Stations: Composite Annual Means of the 24 hour Average TSP Concentrations

Dashed line indicates the National maximum acceptable air quality objective level for the annual geometric mean TSP concentration.

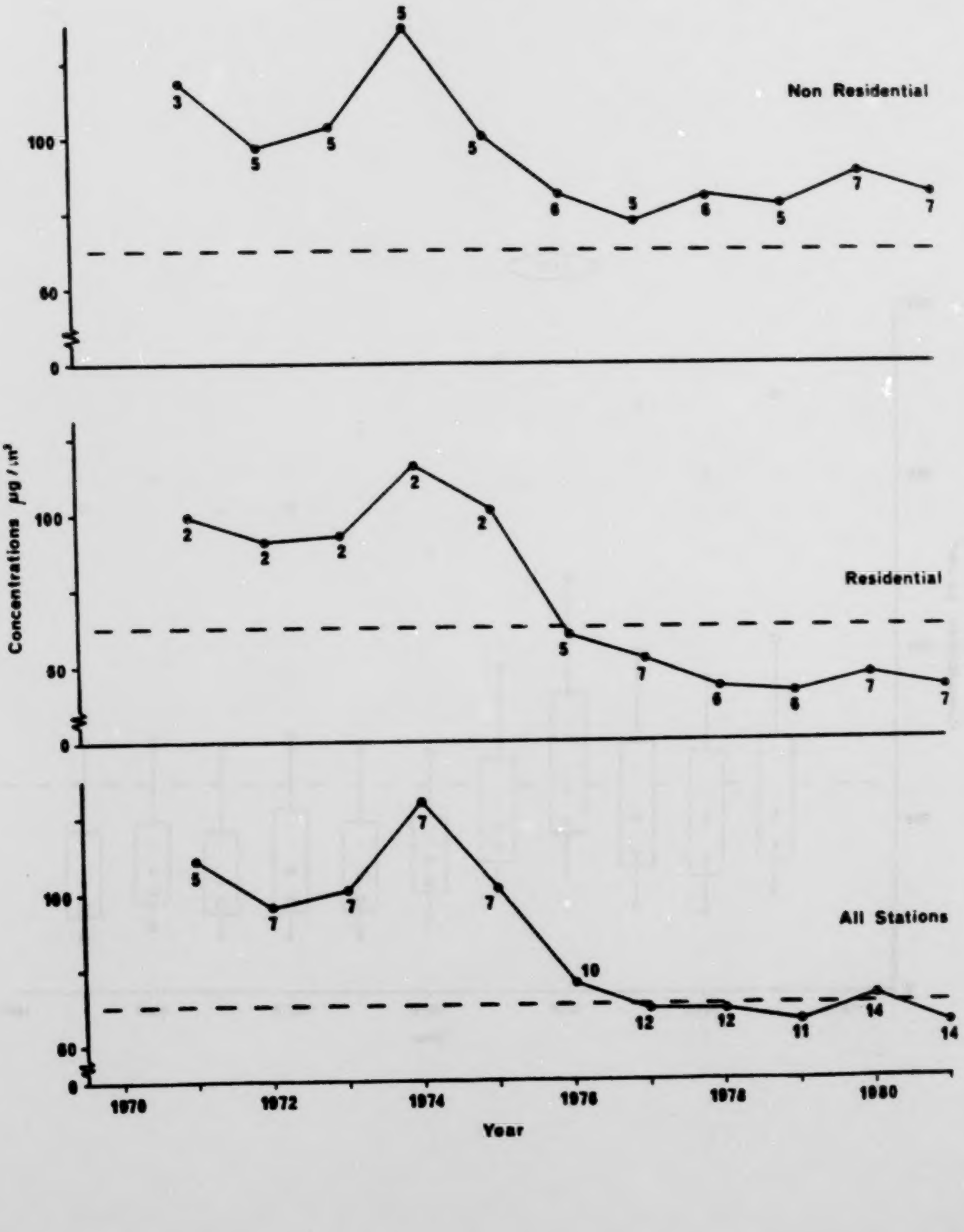


FIGURE: 3.10b Montreal; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations

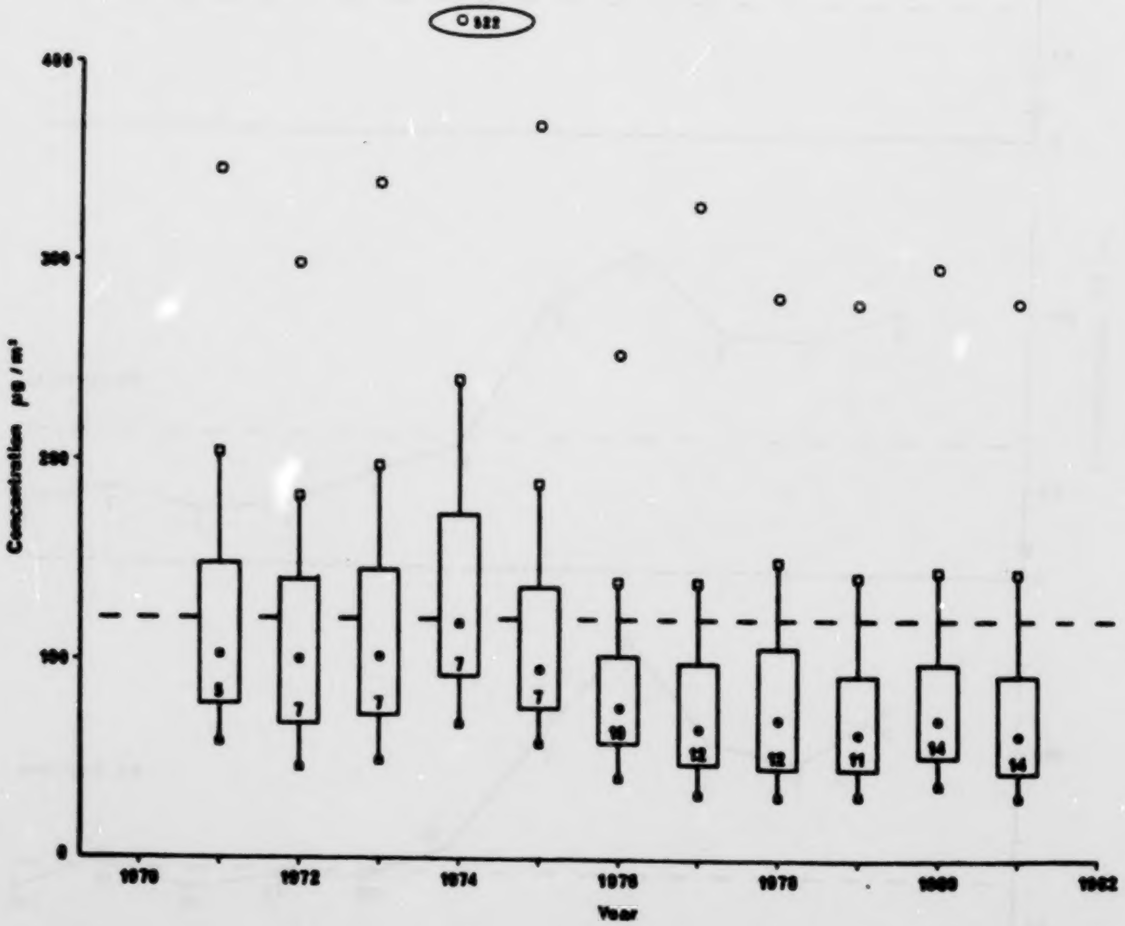


FIGURE 3.10c Montreal; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations

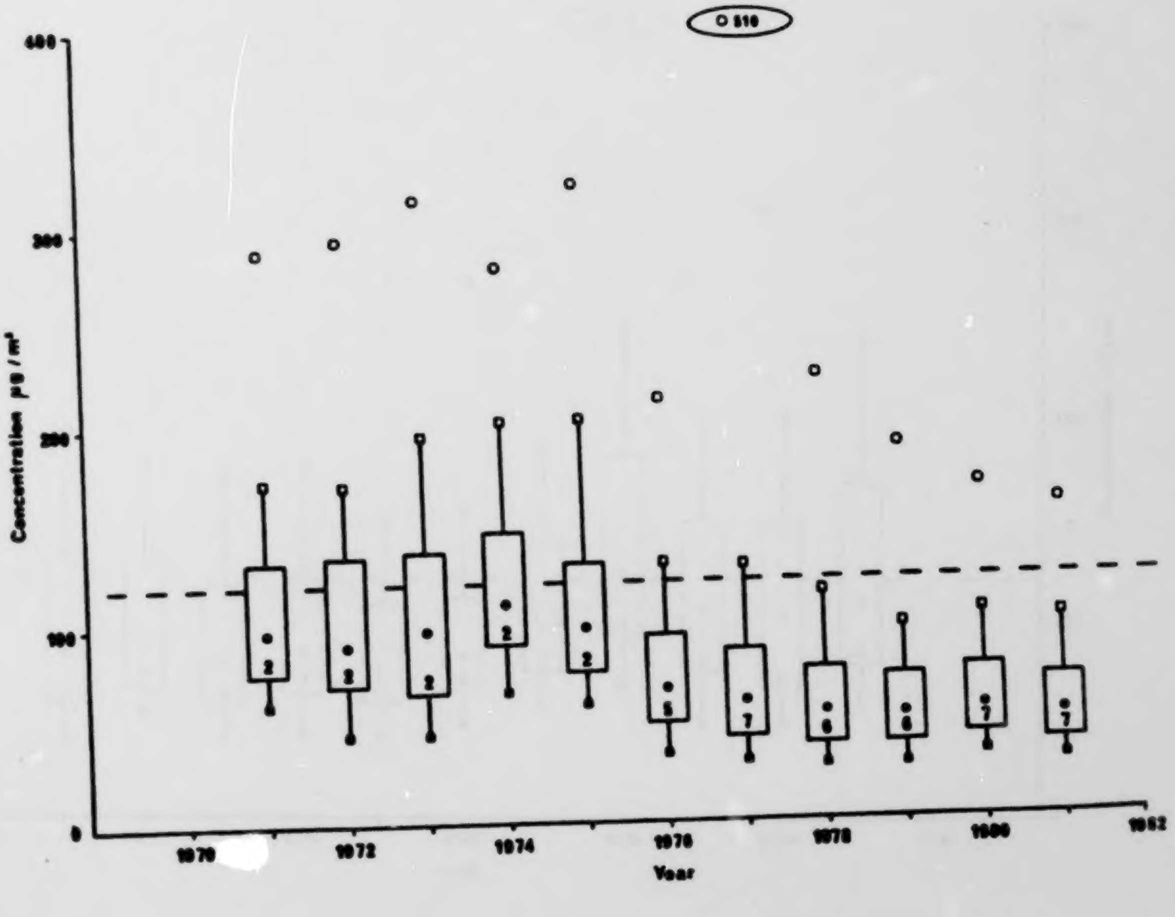
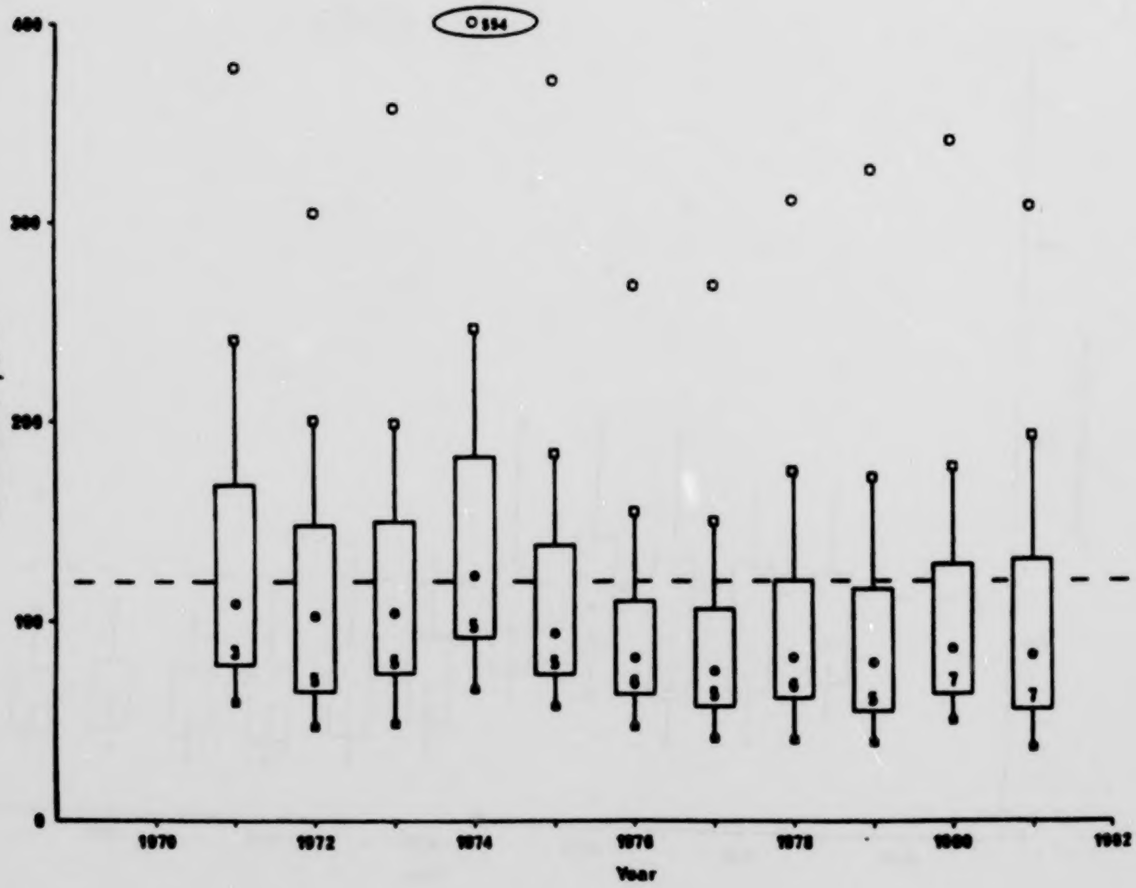


FIGURE: 3.10d Montreal; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations



The composite monthly mean TSP levels show a pattern in which the highest levels occur between March and June with lowest levels each year occuring most often in the colder months of December and January. Plots of the composite monthly means for TSP levels in Montreal are given in Appendices G4.1 to G4.3.

3.4 Air Quality Trends: Vancouver

3.4.1 Vancouver: Carbon Monoxide

The composite annual mean CO level for all Vancouver stations decreased from 1975 to 1976 but since 1977 there has been a gradual increasing trend. See Figure 3.11a. The nonresidential stations showed a general increase in CO levels between 1977 and 1981. The pattern for the residential stations (there were either only one or two stations in this group) showed no consistent upward or downward trend.

Box plots for each of the station groupings are shown in Figure 3.11b - 3.11d. The patterns for the 50th and lower percentiles were similar to those for the annual means. During 1975 and 1979, the concentrations corresponding to the higher percentiles (75th, 90th and 99th) peaked relative to other years.

The one hour average maximum acceptable national air quality objective for CO (31 ppm) was never exceeded but the maximum desirable

FIGURE: 3.11a Vancouver Stations: Composite Annual Means of the hourly CO Concentrations

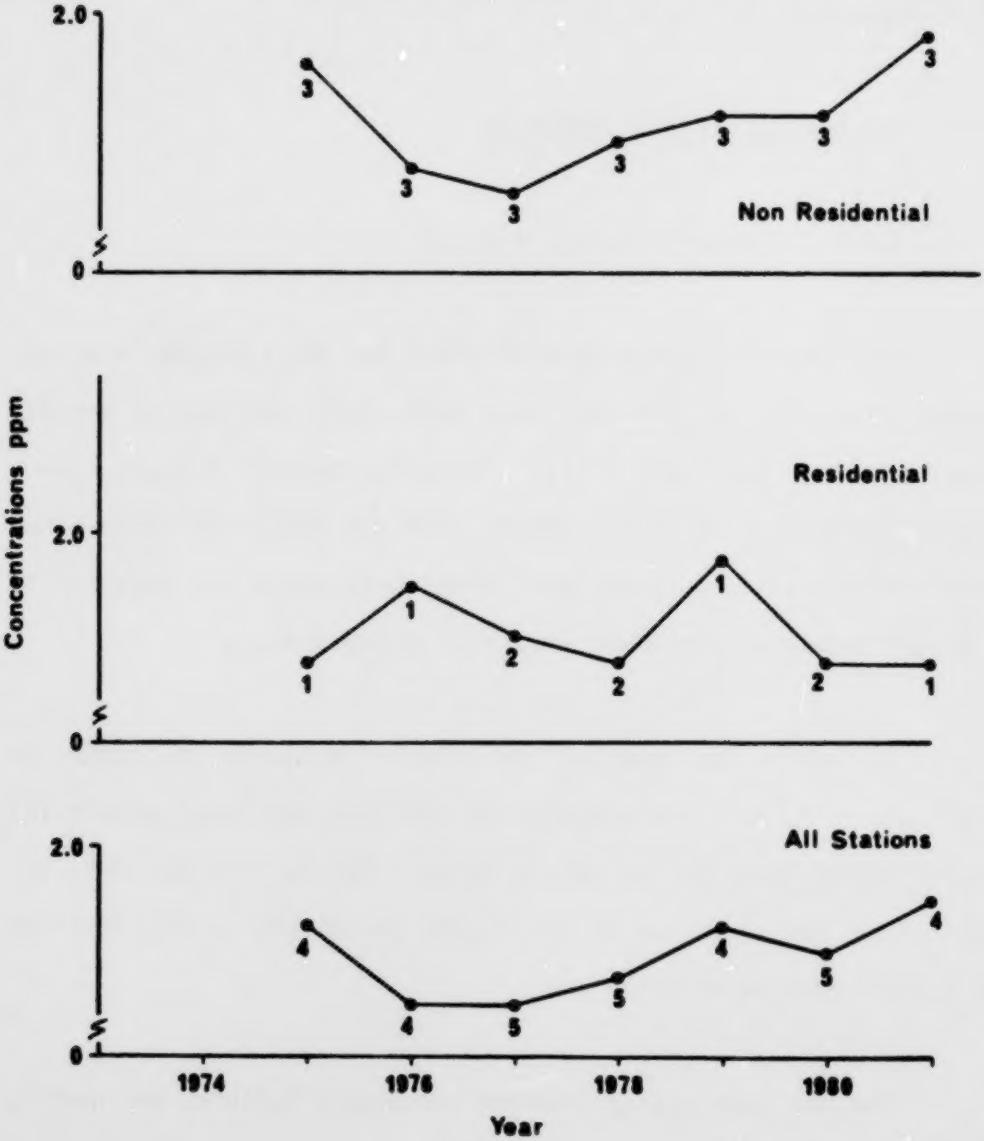


FIGURE: 3.11b Vancouver; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations

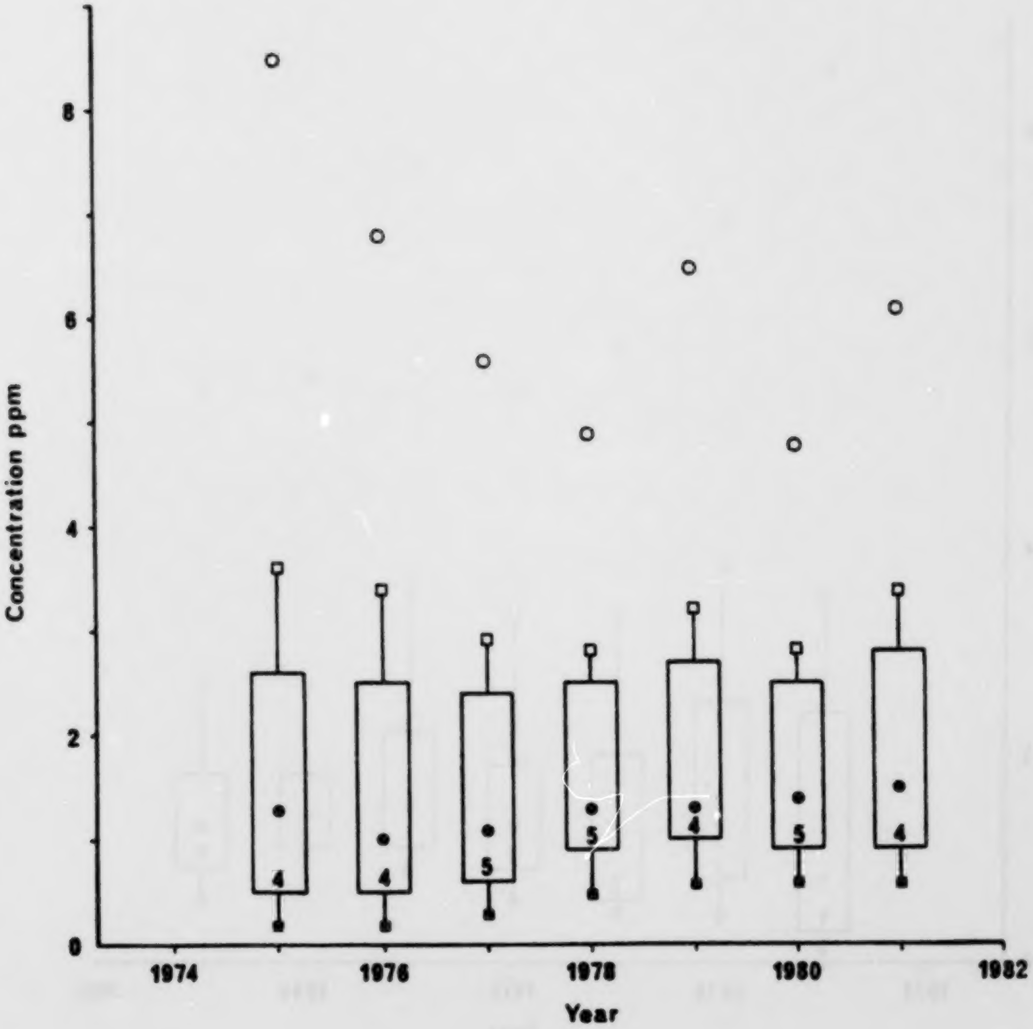


FIGURE 3.11c Vancouver; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations

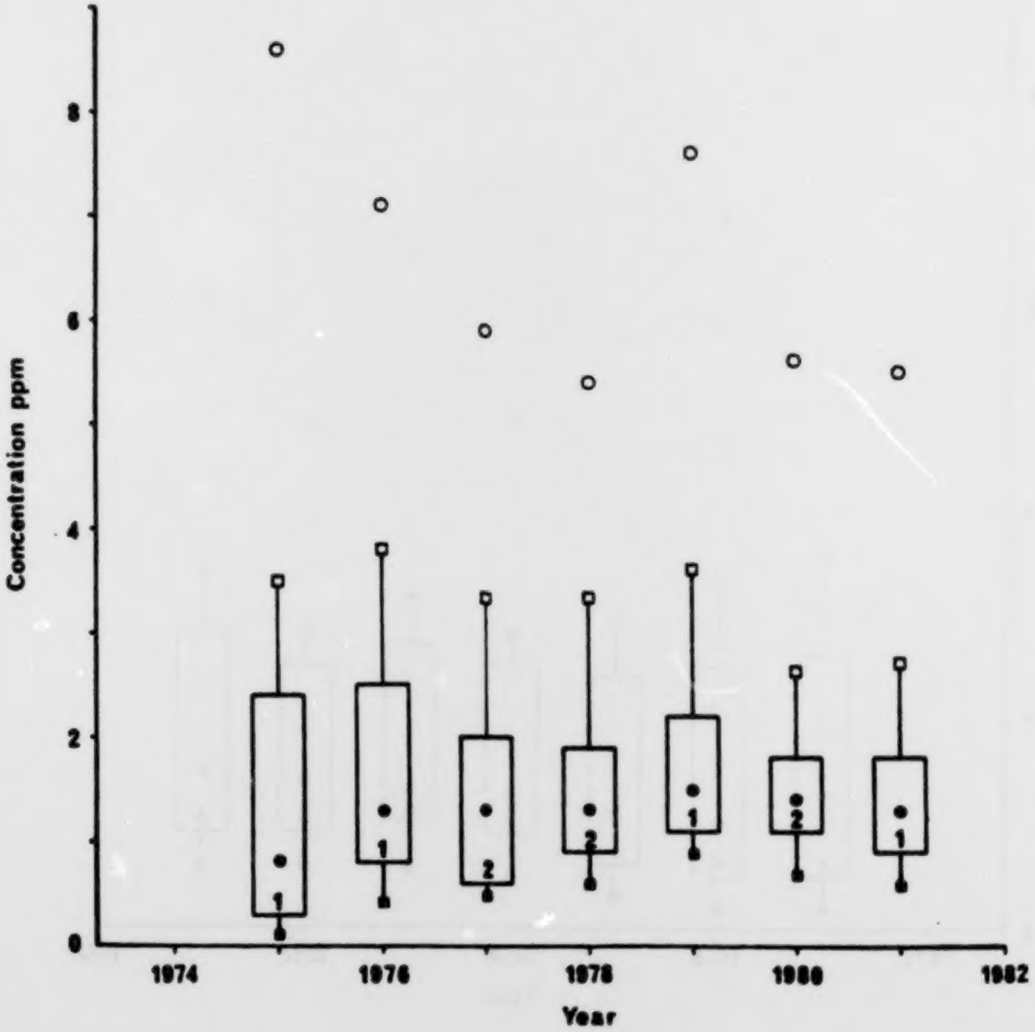
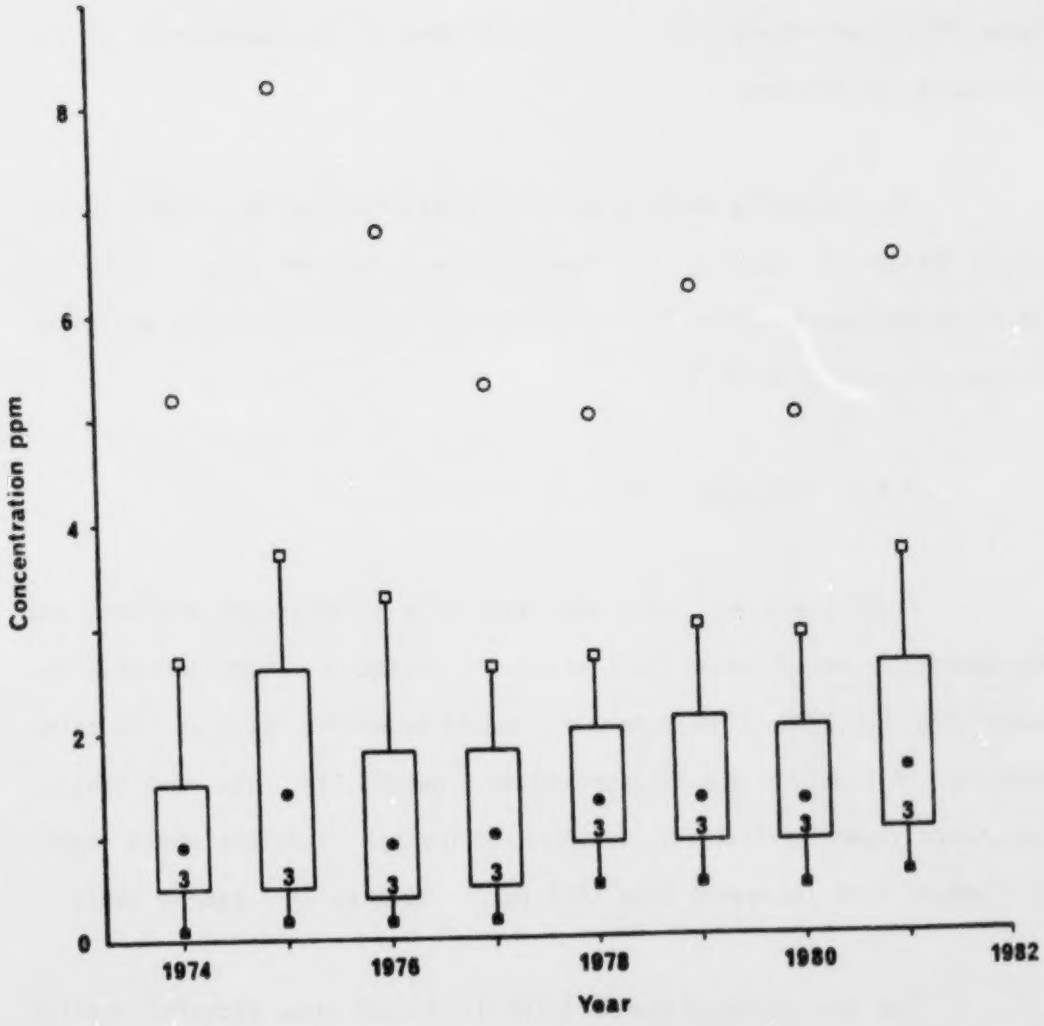


FIGURE 3.11d Vancouver; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations



level (13 ppm) was exceeded most in 1975 on a per station basis. There was a marked increase in 1981 relative to 1980 in the number of exceedances of the 1 hour average maximum desirable air quality objective. The nonresidential stations accounted for this increase. In fact, the numbers of exceedances of the maximum desirable 1 hour average air quality objective for CO at residential stations has generally decreased since 1975. See Appendix D1.3 for tabulations of the exceedances of the air quality objectives.

The composite monthly mean CO levels tend to be highest in the months October to December and lowest between May and July. Plots for the composite monthly mean CO levels for each station grouping are given in Appendices H1.1 to H1.3.

3.4.2 Vancouver: Nitrogen Dioxide.

Four years NO_2 data were available at Vancouver stations and the composite annual means (all stations) showed a slight increase between 1978 and 1981. The composite annual means for each of the three groupings of stations are illustrated in Figure 3.12a. The most consistent trend shown is that for the five residential stations whose composite annual mean increased from 18.7 ppb in 1978 to 21.6 ppb in 1981.

The box plots (Figures 3.12b to 3.12d) show patterns similar to those for the annual means in that the only (small) general increase in the percentiles occurred for the residential stations.

FIGURE: 3.12a Vancouver Stations: Composite Annual Means of the hourly NO_2 Concentrations

Dashed line indicates the National maximum acceptable air quality objective level for the annual arithmetic NO_2 concentration.

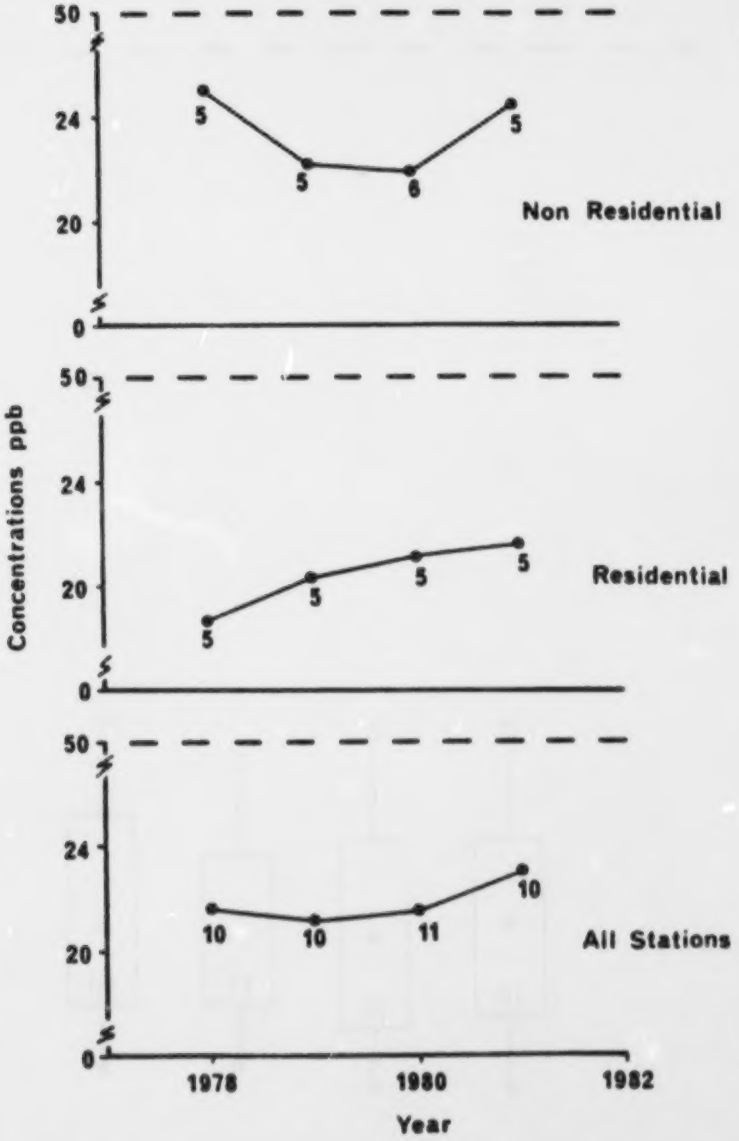


FIGURE: 3.12b Vancouver; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations

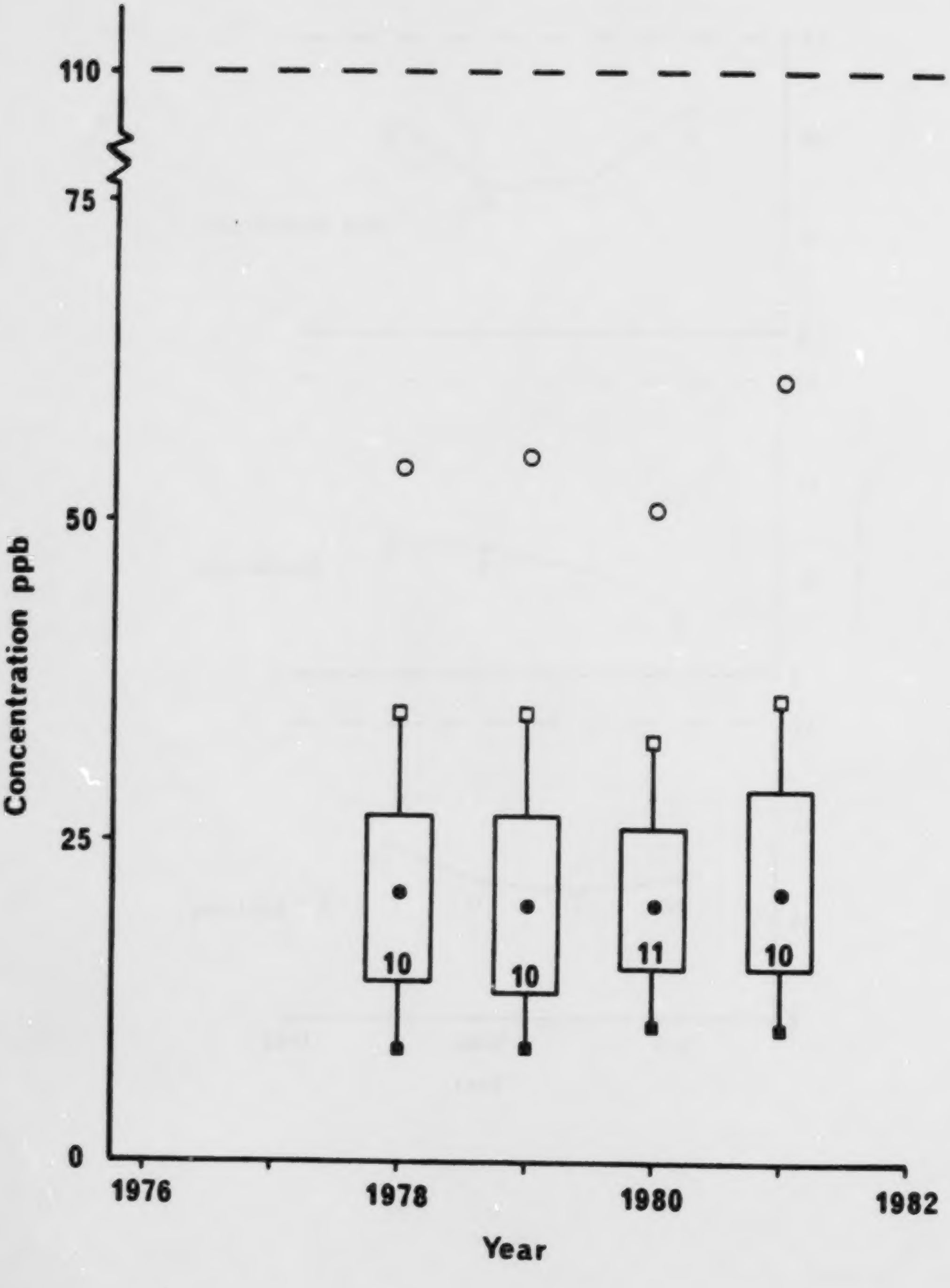


FIGURE: 3.12c Vancouver; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations

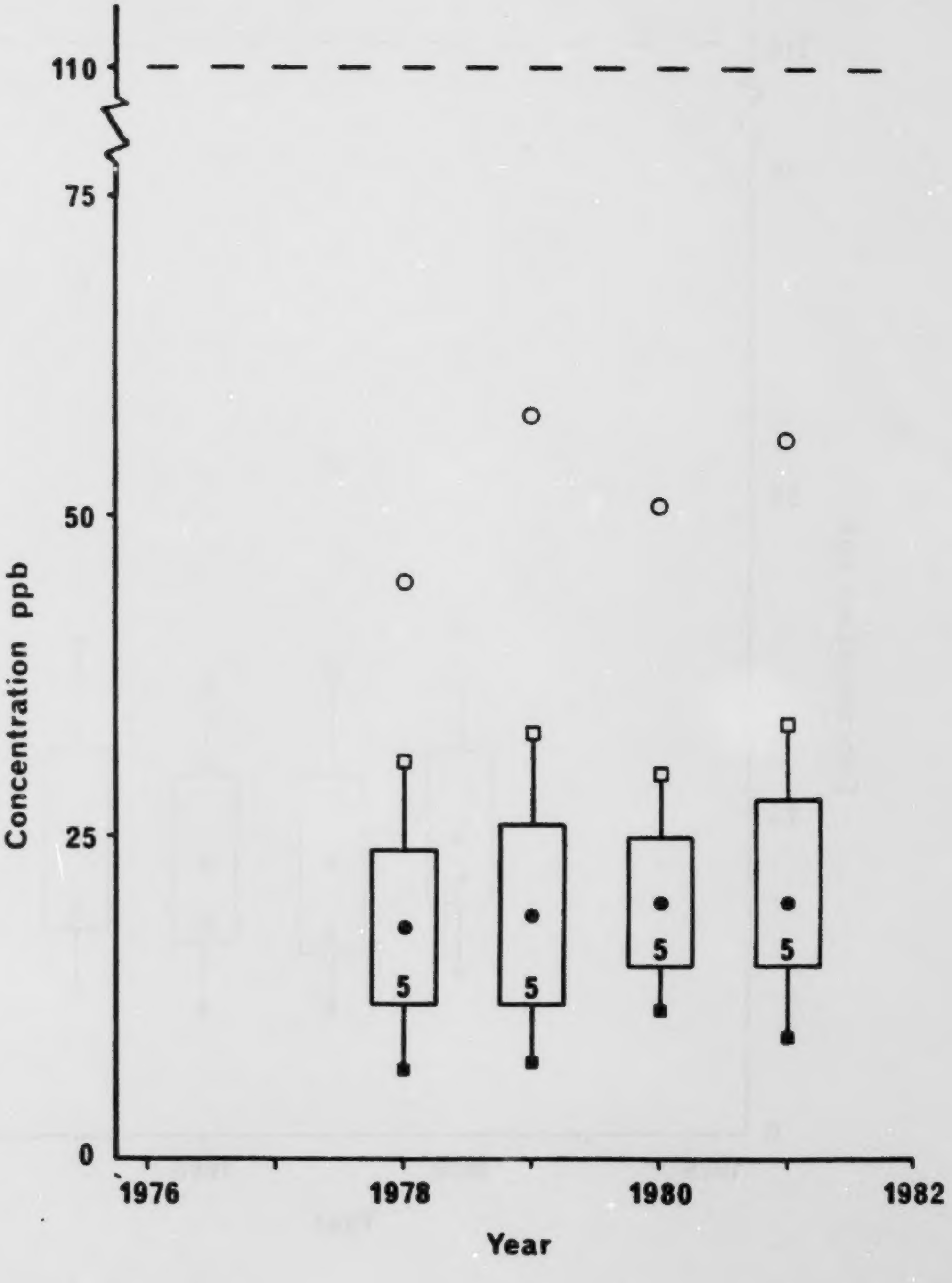
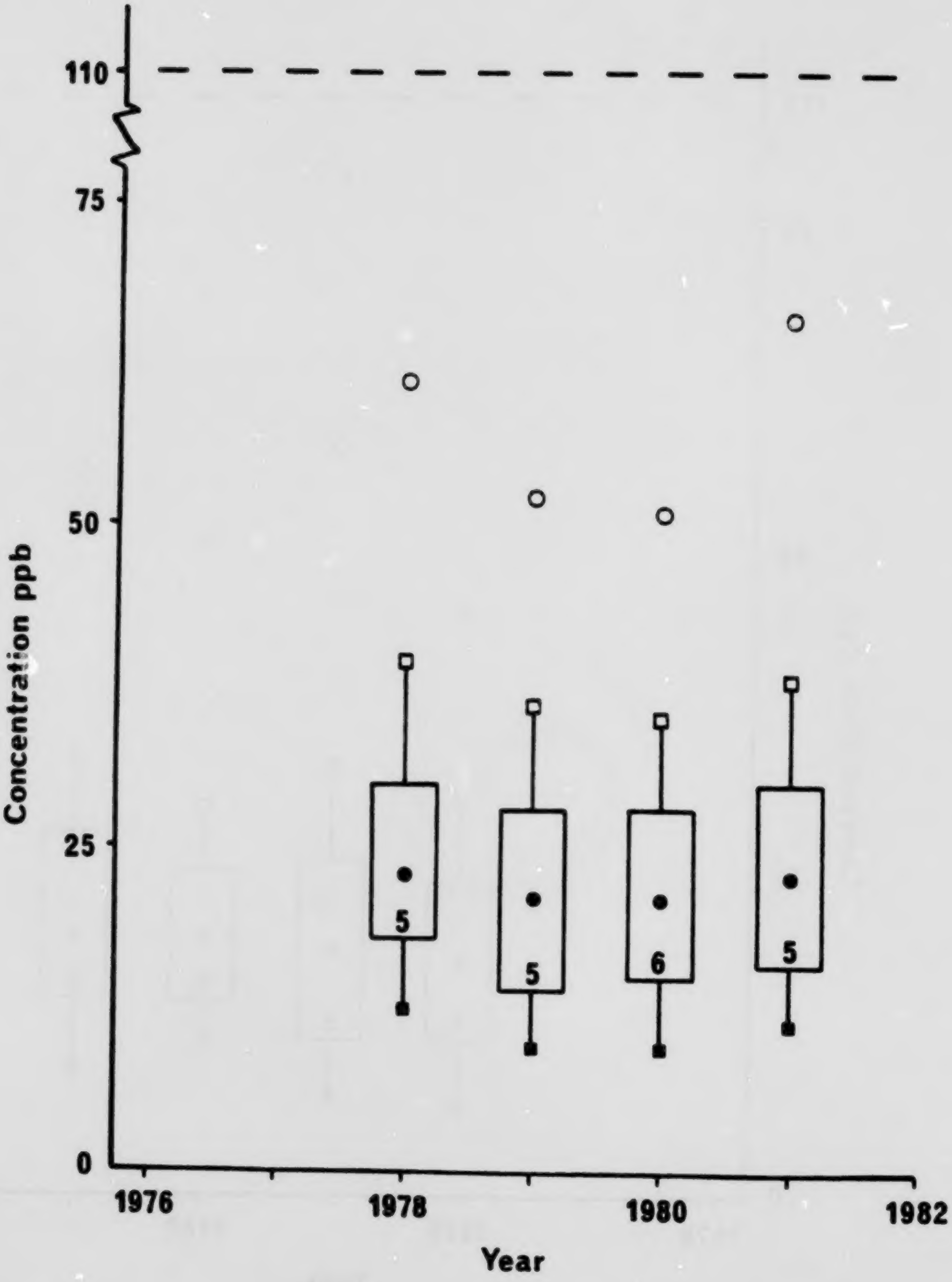


FIGURE: 3.12d Vancouver; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations



There was only one exceedance each of the maximum acceptable air quality level averaged over 1 hour and the maximum desirable air quality level averaged over 24 hours.

The variation of the composite monthly mean NO_2 levels (See Appendices D2.1 to D2.3) indicate that lower levels tend to occur in the May to July period and also in December and January with peaks during September/October and March/April.

3.4.3 Vancouver: Ozone

Composite annual means for the three groupings of stations are plotted in Figure 3.13a. There was a general increase in the composite annual means for the residential stations as well as for all stations but for the nonresidential group, the annual means remained the same in 1978 and 1979, decreased in 1980 but rose again in 1981 to 12.7 ppb - a level slightly above the 1978/1979 level of 12.3 ppb.

The box plots (Figures 3.13b-3.13d) show patterns similar to the annual means. The ozone concentrations corresponding to the 99th percentiles were highest in 1981 but the 90th percentile of the 24 hour average data for all stations was always greater than the maximum acceptable air quality objective (averaged over 24 hours).

Exceedances of the various air quality objectives for ozone occurred regularly in Vancouver. The maximum tolerable one hour average

FIGURE: 3.13a Vancouver Stations: Composite Annual Means of the hourly O_3 Concentrations.

Dashed line indicates the National maximum acceptable air quality objective level for the annual arithmetic mean O_3 concentration.

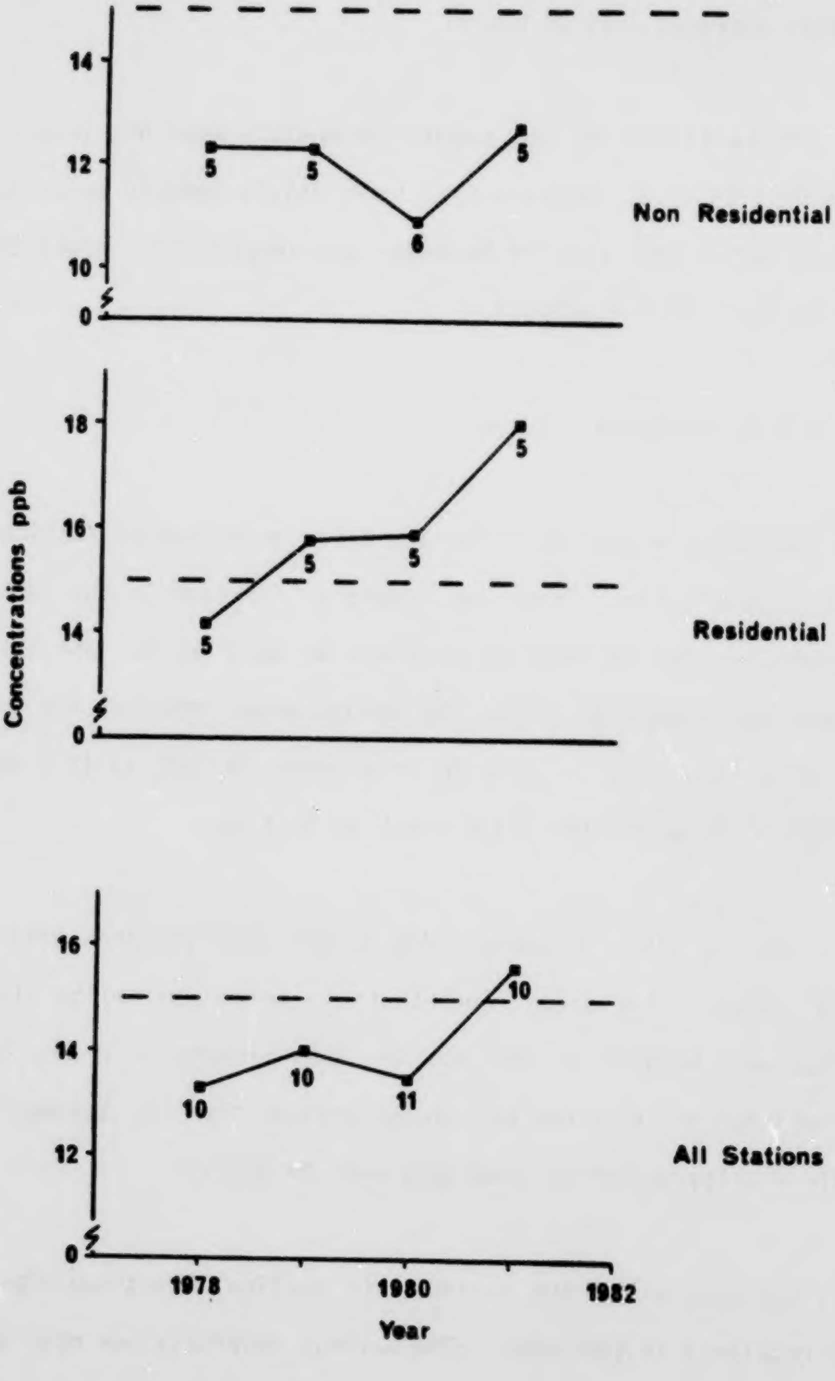


FIGURE: 3.13b Vancouver; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations

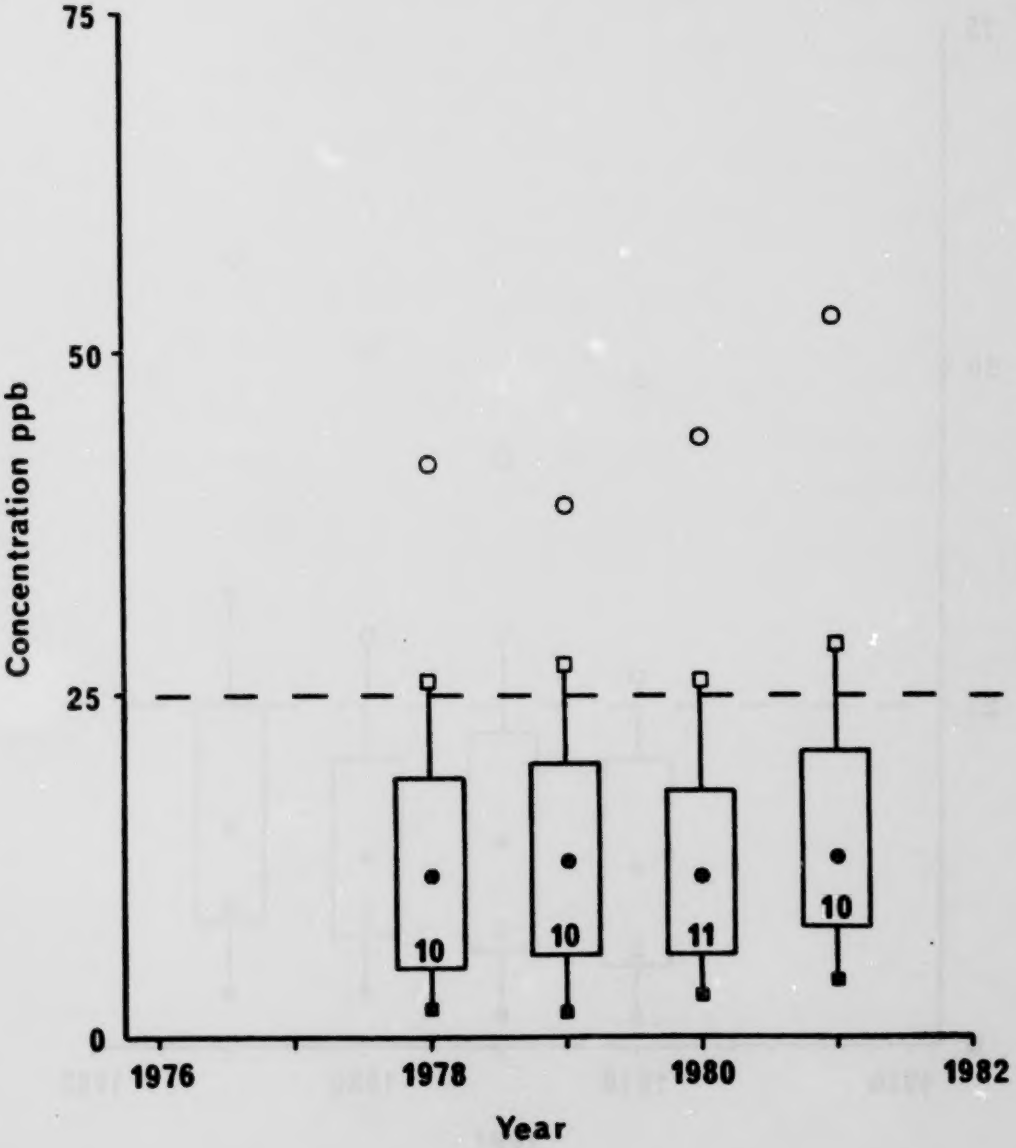


FIGURE: 3.13c Vancouver; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations

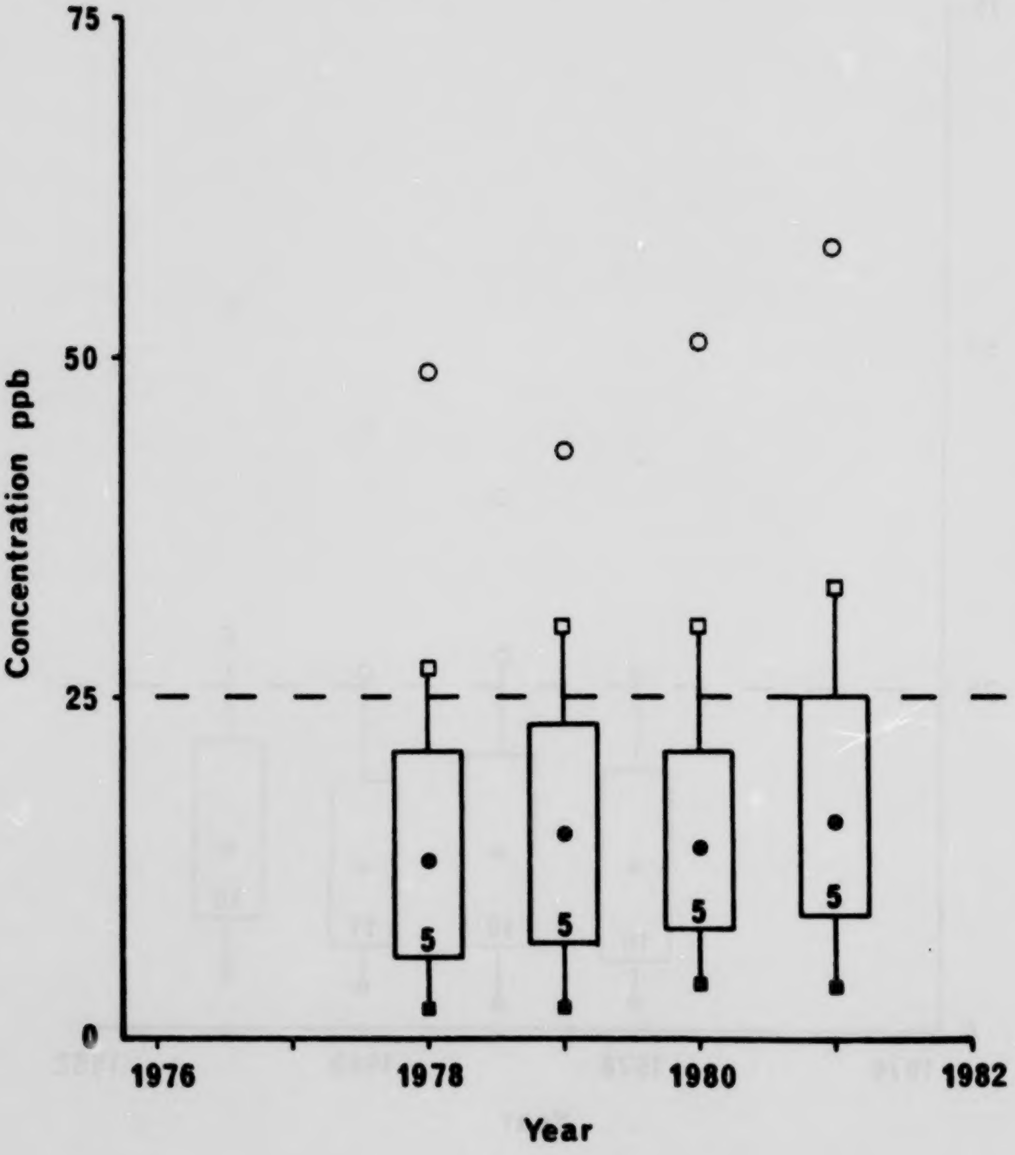
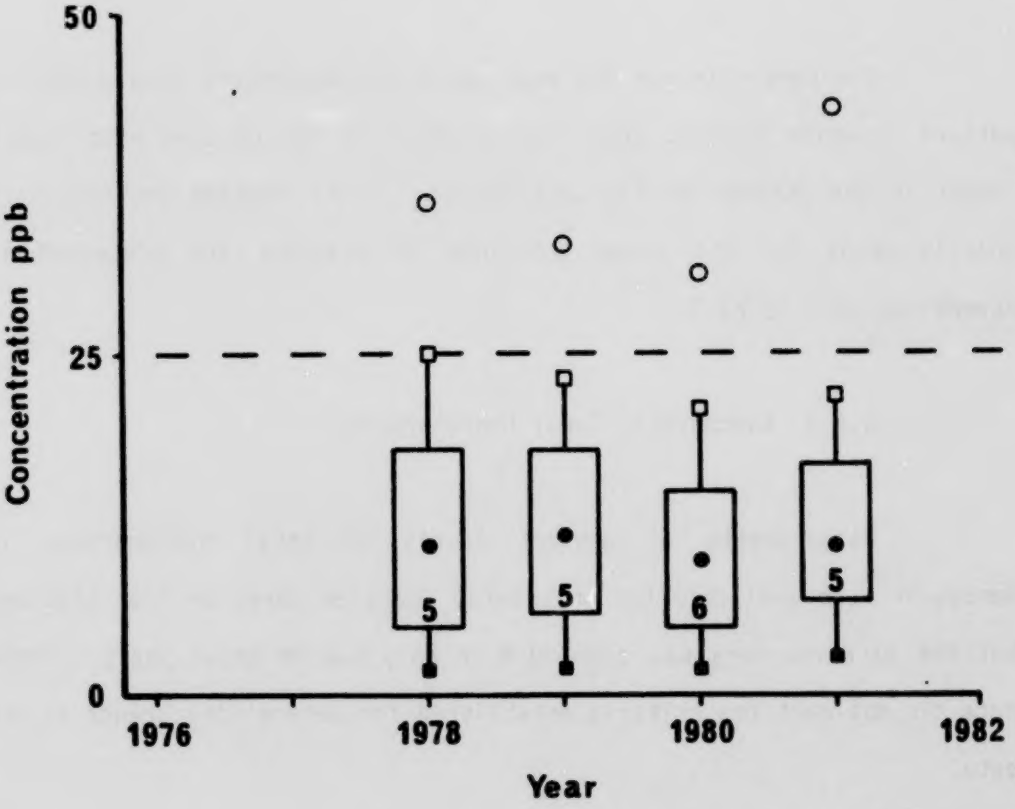


FIGURE: 3.13d Vancouver; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations



ozone air quality objective was exceeded 88 times between 1978 and 1981: of these, 62 occurred in 1981. The maximum acceptable 24 hour average air quality objective for ozone was exceeded most often in 1979 with 404 exceedances. Note that since there were ten stations operating in Vancouver in 1979 these exceedances would have occurred on about 40 days of the year. There were 29, 30, 41 and 39 days in each of the years 1978 to 1981 respectively on which at least one station recorded an ozone episode. An episode was defined as the occurrence of ozone levels greater than 82 ppb of three or more consecutive hours (Concord Scientific Corporation 1982).

The composite monthly mean ozone concentrations show a regular pattern in which highest ozone levels occur in May or June with lowest levels in the October to February period. Plots showing the composite monthly means for the three groupings of stations are presented in Appendices H3.1 to H3.3.

3.4.4 Vancouver: Total Hydrocarbons

Measurements of ambient levels of total hydrocarbons in Vancouver were available for only three years at three or four stations but the data recovery was over 50 % in only two of those years. These data did not meet the criteria established for determining trends in the data.

3.4.5 Vancouver: Total Suspended Particulates

The annual geometric means (all stations) for TSP levels in Vancouver decreased consistently from 1970 to 1975 (from 91.2 to 45.7 $\mu g/m^3$). For the subsequent years, the composite mean varied between 61.2 and 47.8 $\mu g/m^3$. The patterns for the residential and nonresidential groups of stations were similar (see Figure 3.14a).

The box plots are shown in Figures 3.14b to 3.14d. Since 1973, the concentrations corresponding to most percentiles (for all stations) have been fairly constant. The higher percentiles (90th and 99th) showed the greatest variation and for the nonresidential stations there was a general trend towards higher levels for these percentiles in the later years.

The maximum tolerable 24 hour average air quality objective for TSP was never exceeded in Vancouver but the maximum acceptable objective was exceeded regularly. Most exceedances of this objective occurred in 1979 (55 occurrences from seven stations) and fewest in 1972 (5 occurrences at two stations). There is no apparent similarity in the variation of the numbers of exceedances (of the maximum acceptable 24 hour average air quality objective for TSP) with the composite annual geometric means. Tabulations of these exceedances are given in Appendix D4.3.

FIGURE: 3.14a Vancouver Stations: Composite Annual Means of the 24 hour Average TSP Concentrations

Dashed line indicates the National maximum acceptable air quality objective level for the annual geometric mean TSP concentration.

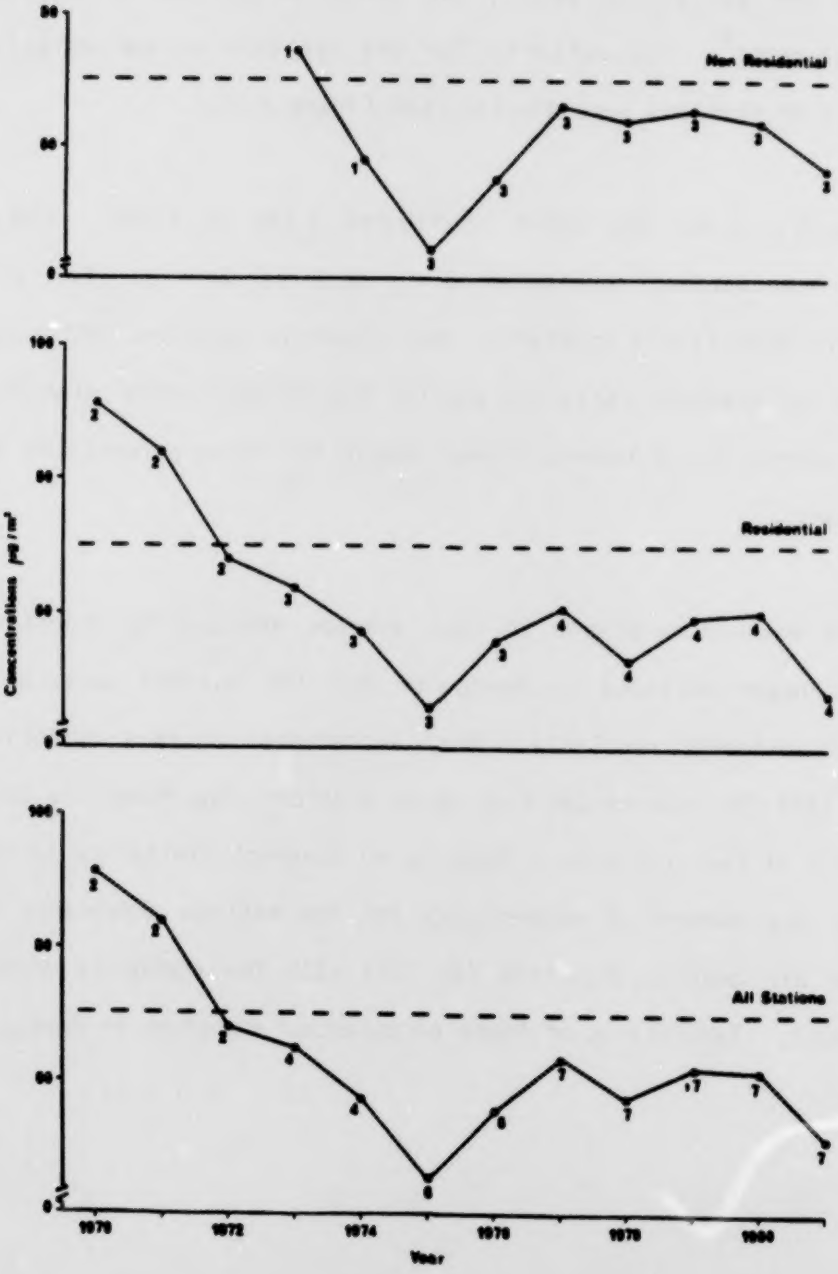


FIGURE 3.14b Vancouver; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations

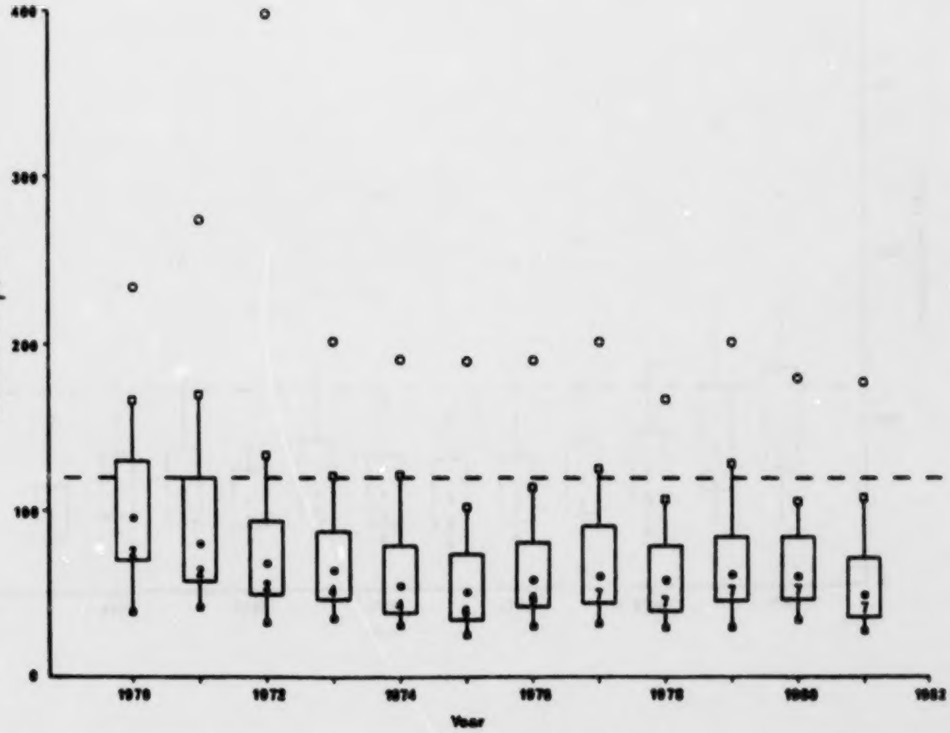


FIGURE 3.14c Vancouver; Residential Stations: Box Plots for the Annual Frequency Distribution of 24 hour Average TSP Concentrations

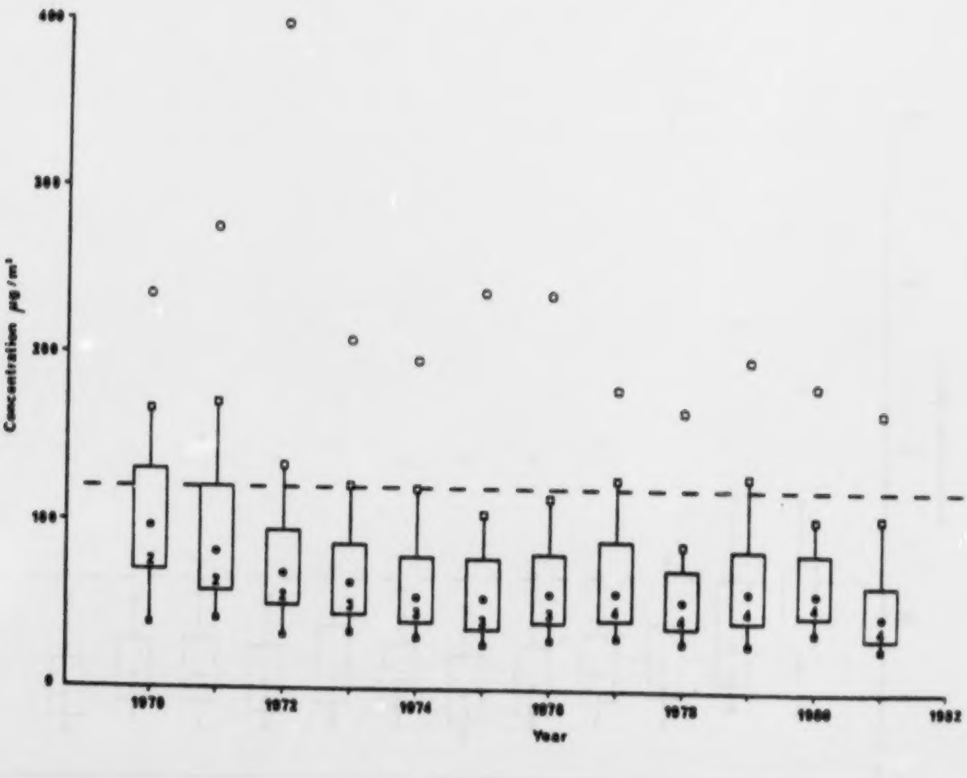
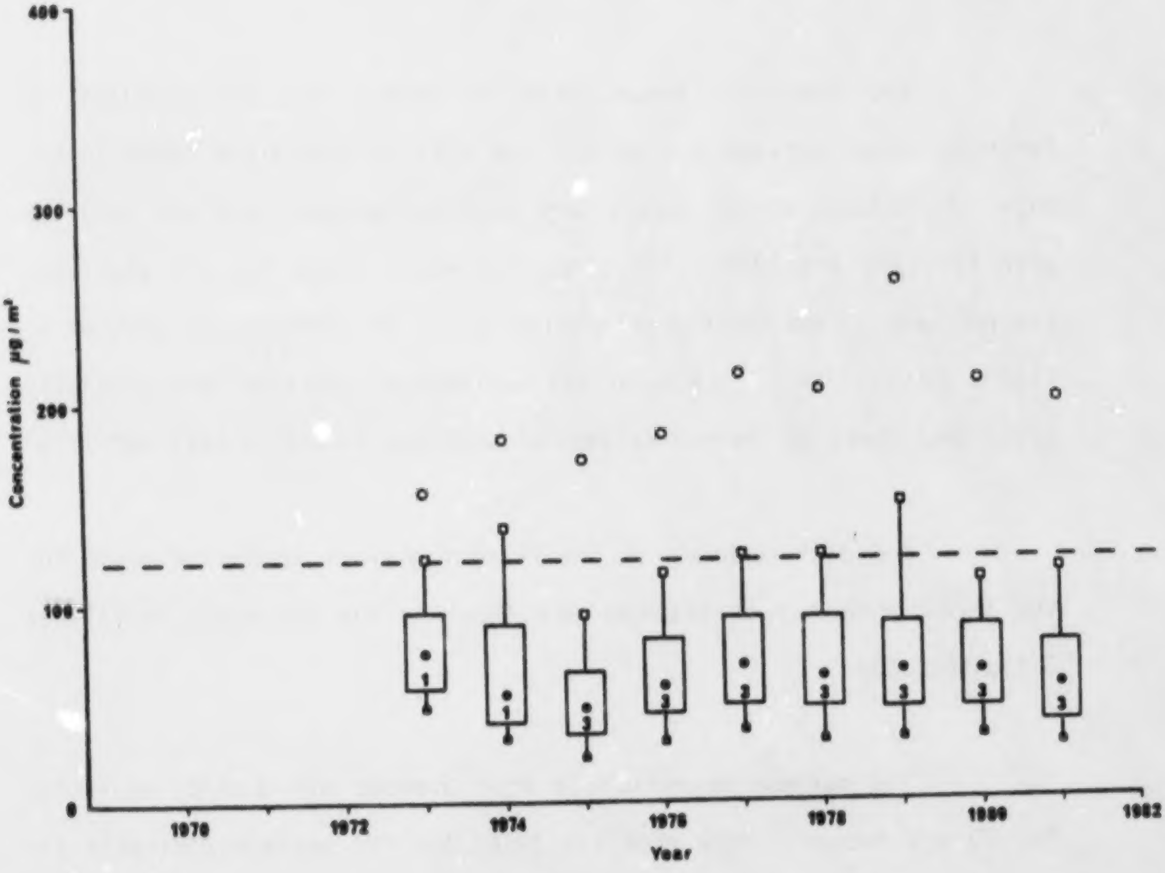


FIGURE: 3.14d Vancouver; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations



The composite monthly geometric mean TSP concentrations (See Appendices H4.1 to H4.3 for plots) show a varied pattern. Lowest levels often occurred between November and February but some January's recorded peak levels.

3.5 Air Quality Trends: Edmonton

3.5.1 Edmonton: Carbon Monoxide

The composite annual mean CO levels for all stations in Edmonton varied between 1.4 and 2.2 ppm with no consistent trend in the data. Relatively higher levels were recorded between 1971 and 1973 and also for 1979 and 1980. The composite annual means for all stations, the residential and the nonresidential groups of stations are plotted in Figure 3.15a. The CO levels at the residential stations were generally lower than those at the nonresidential stations except in 1975 and 1976.

The distributions of the 24 hour average composite means for the three groupings of stations are shown in the box plots in Figures 3.15b to 3.15d.

The maximum acceptable 1 hour average air quality objective for CO was exceeded only once (in 1976) but the maximum desirable air quality objective was exceeded regularly in all but one year. Most exceedances of this objective (124) occurred in 1979.

FIGURE: 3.15a Edmonton Stations: Composite Annual Means of the hourly CO Concentrations

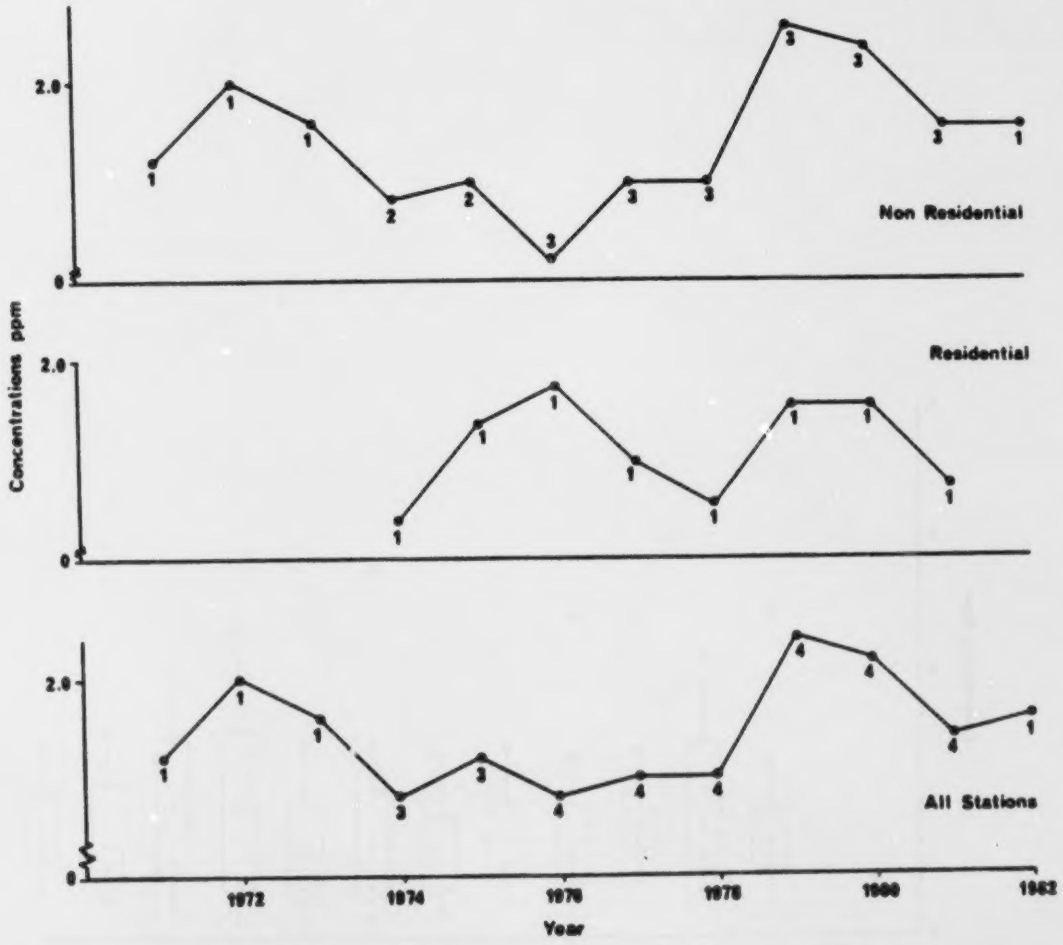


FIGURE: 3.15b Edmonton; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations

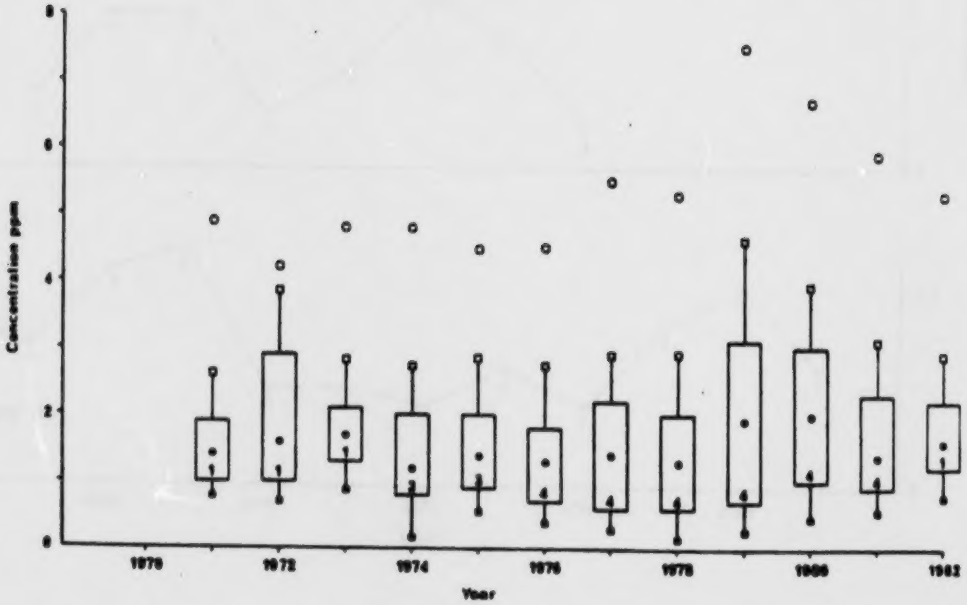


FIGURE: 3.15c Edmonton; Residential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations

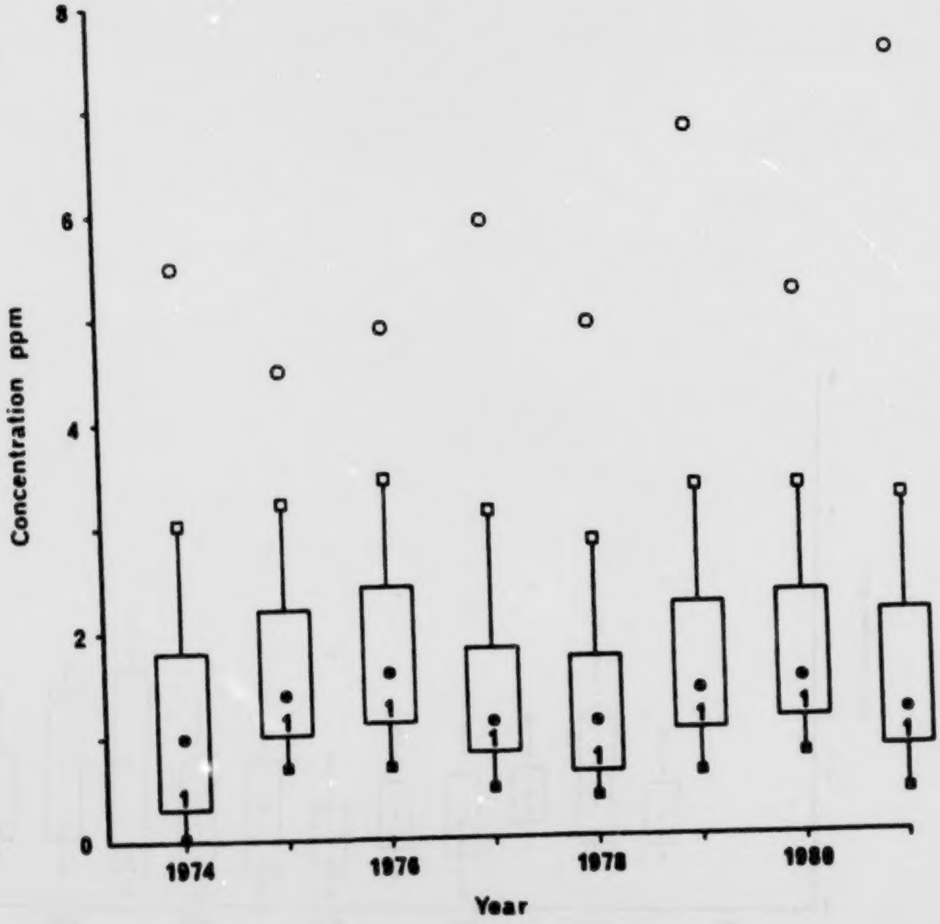
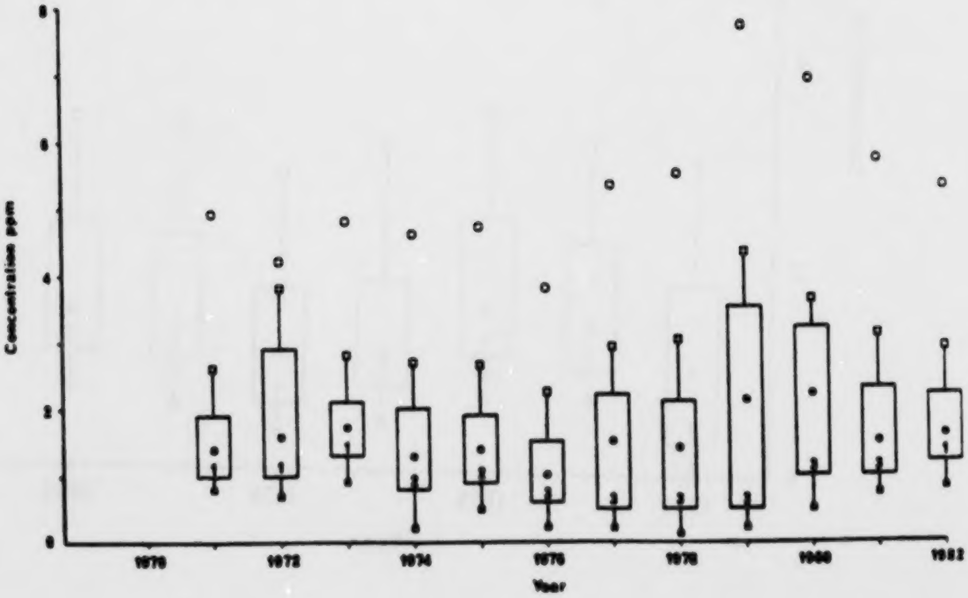


FIGURE: 3.15d Edmonton; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average CO Concentrations



The composite monthly mean CO concentrations are highest in the cooler months - November through February and are lowest typically between April and July. Plots of the composite monthly means are given in Appendix I1.1 to I1.3.

3.5.2 Edmonton: Nitrogen Dioxide

The various composite annual means for NO_2 levels in Edmonton are shown in Figure 3.16a. Since 1975, the levels have remained fairly constant except for the nonresidential stations at which the 1975 and 1976 levels were noticeably higher than in subsequent years.

The distribution of the daily means for the three groupings of stations are shown in box plots (Figures 3.16b to 31.6d). The plots do not show any consistent pattern over the years. At the nonresidential stations in 1975 and 1976, the composite annual means exceeded the maximum acceptable annual mean NO_2 air quality objective.

The NO_2 levels at the nonresidential station(s) are higher than those at the residential station. The air quality objectives for NO_2 (the maximum acceptable 1 hour and 24 hour averages) were exceeded only at the nonresidential station (see Appendix E2.3).

The composite monthly mean NO_2 levels are generally higher in the colder months of the year, January or February, but the highest composite monthly mean NO_2 level has occurred as late as April (in 1977)

FIGURE: 3.16a Edmonton Stations: Composite Annual Means of the hourly NO_2 Concentrations

Dashed line indicates the National maximum acceptable air quality objective level for the annual arithmetic NO_2 concentration.

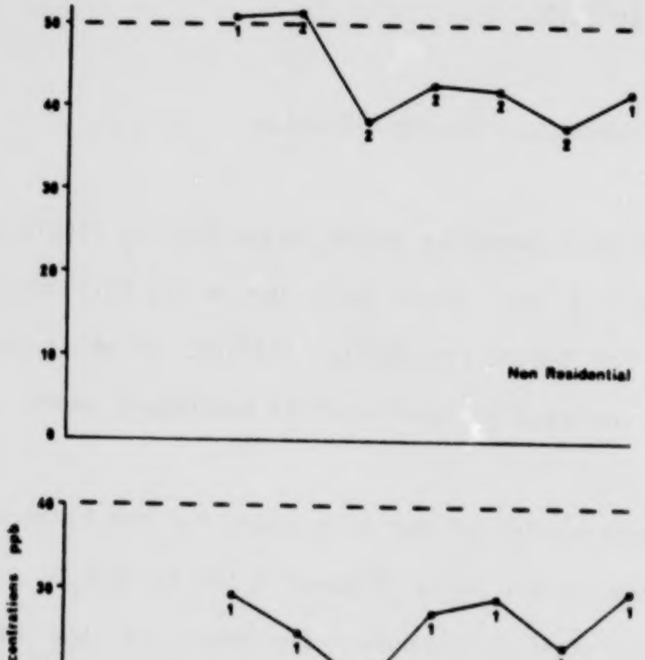


FIGURE: 3.16b Edmonton; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations

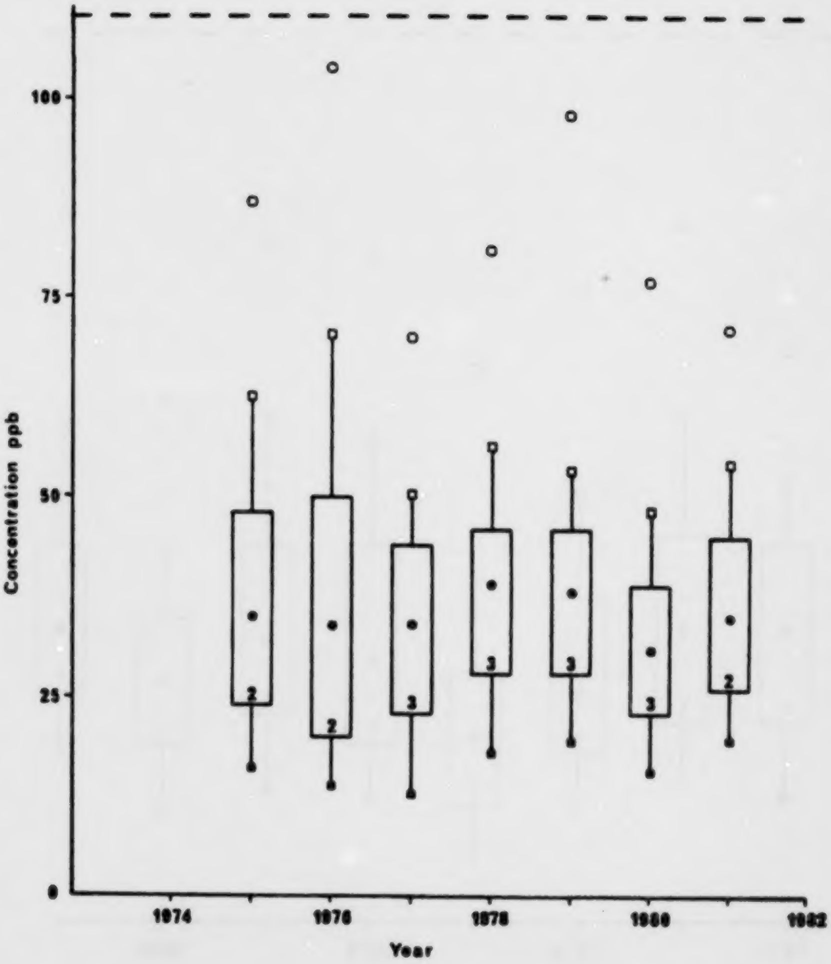


FIGURE: 3.16c Edmonton; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations

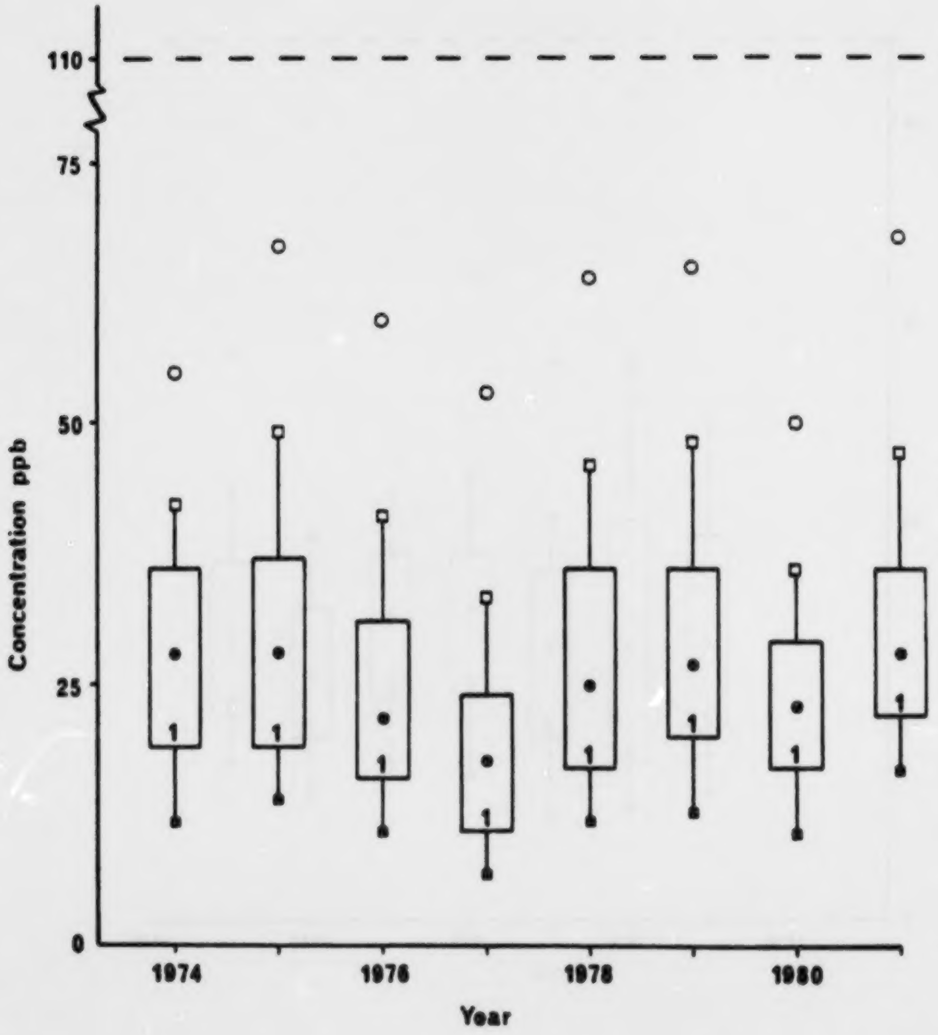
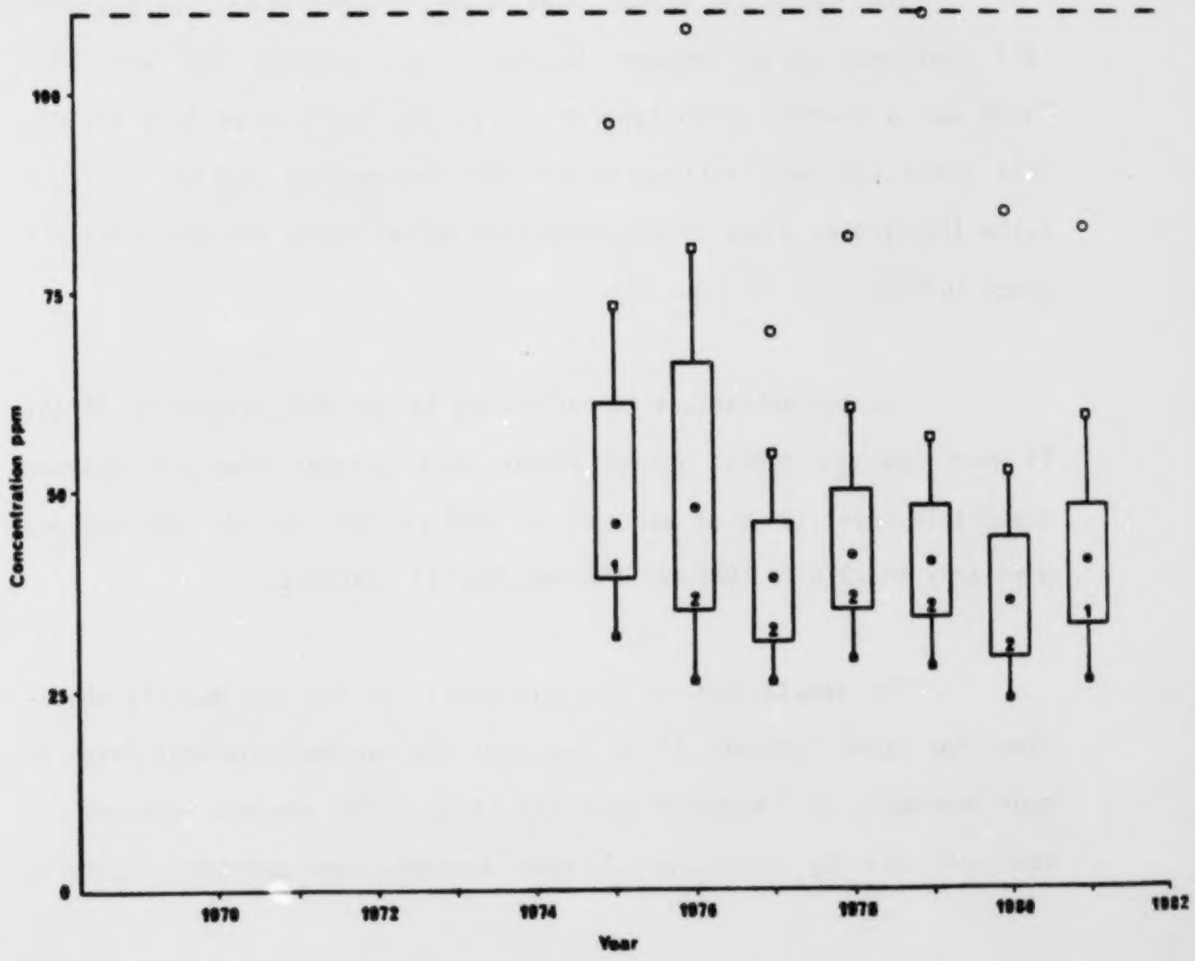


FIGURE: 3.16d Edmonton; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average NO_2 Concentrations



or March (1980). The lower mixing heights and generally poorer pollutant dispersion in the colder months are expected to be the major factors in accounting for higher NO_2 (and other primary gaseous pollutants) levels in the colder months.

3.5.3 Edmonton: Ozone

The composite annual mean ozone concentrations in Edmonton (all stations) varied between 12 and 15 ppb between 1978 and 1982. There was a general trend towards increasing levels over this period. This trend was most noticeable for the residential station. Figure 3.17a illustrates plots of the composite annual means and box plots are given in Figures 3.17b to 3.17d.

The concentrations corresponding to the 90th percentile of the 24 hour average ozone concentrations were greater than the maximum acceptable level (24 hour average) in 1979 to 1982 for all stations and similarly in 1978 to 1981 for the residential stations.

The tabulations of the exceedances of the air quality objectives for ozone (Appendix E3.3) show that the maximum tolerable level (1 hour average), was exceeded once (in 1979). The maximum acceptable 1 hour air quality objective (1 hour average) was exceeded regularly

FIGURE 3.17a Edmonton Stations: Composite Annual Means of the hourly O_3 Concentrations

Dashed line indicates the National maximum acceptable air quality objective level for the annual arithmetic mean O_3 concentration.

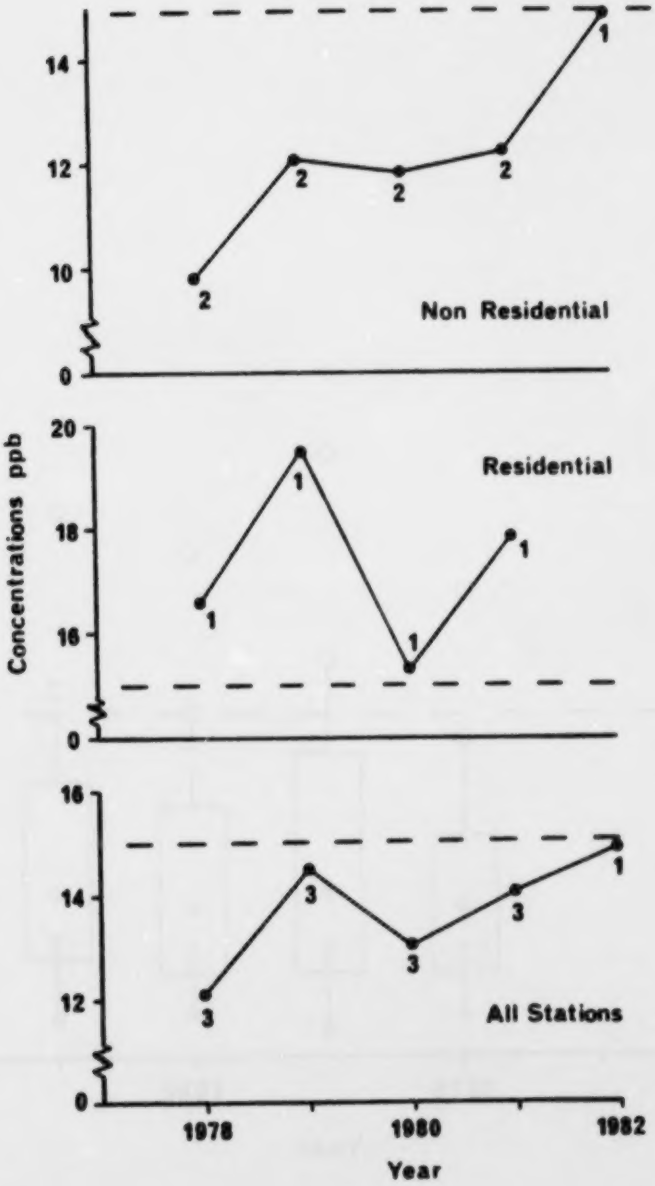


FIGURE: 3.17b Edmonton; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations

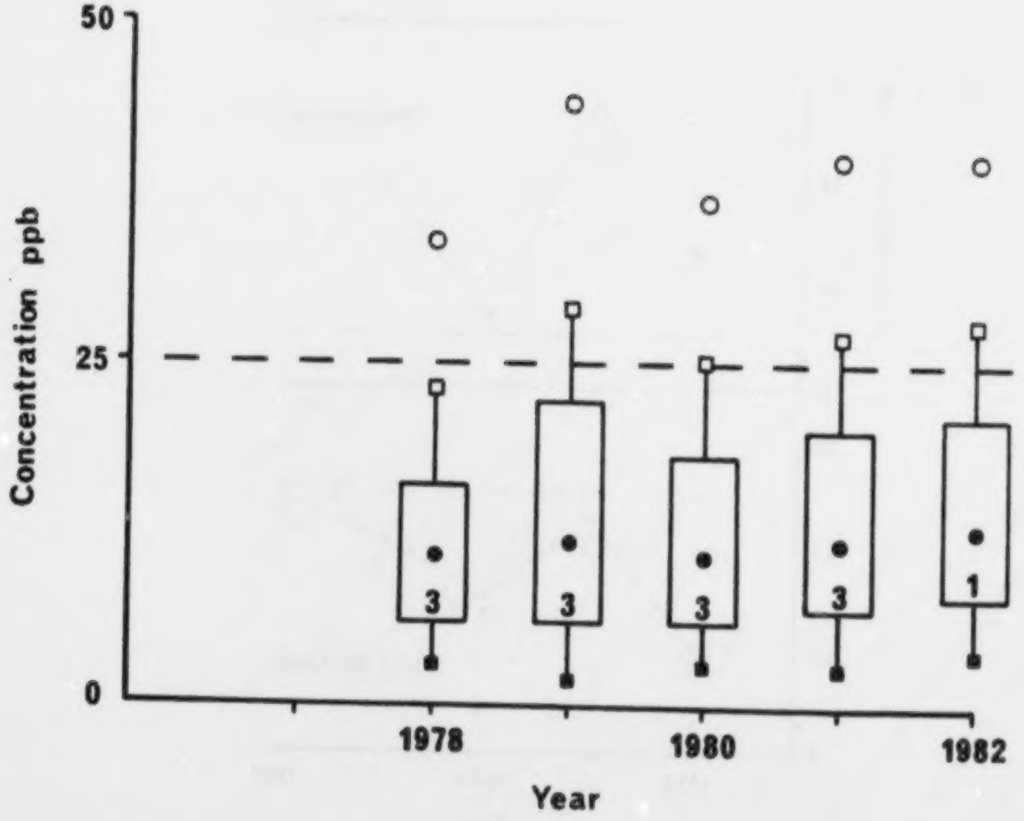


FIGURE: 3.17c Edmonton; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations

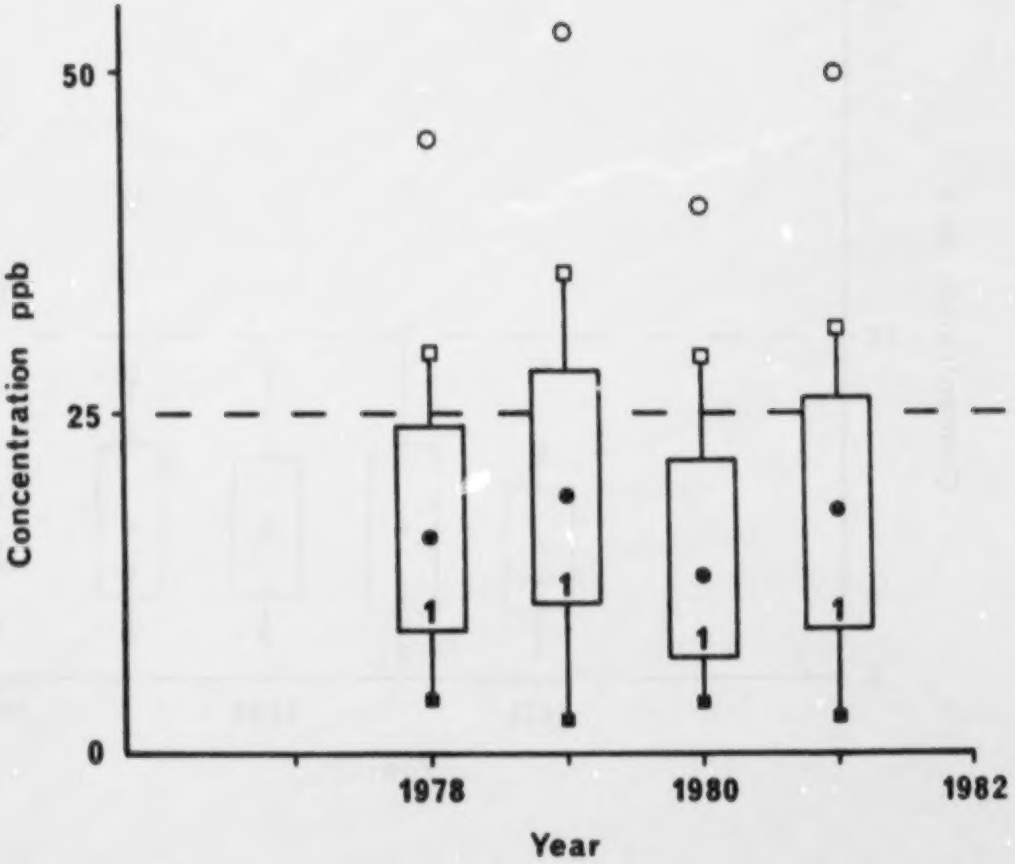
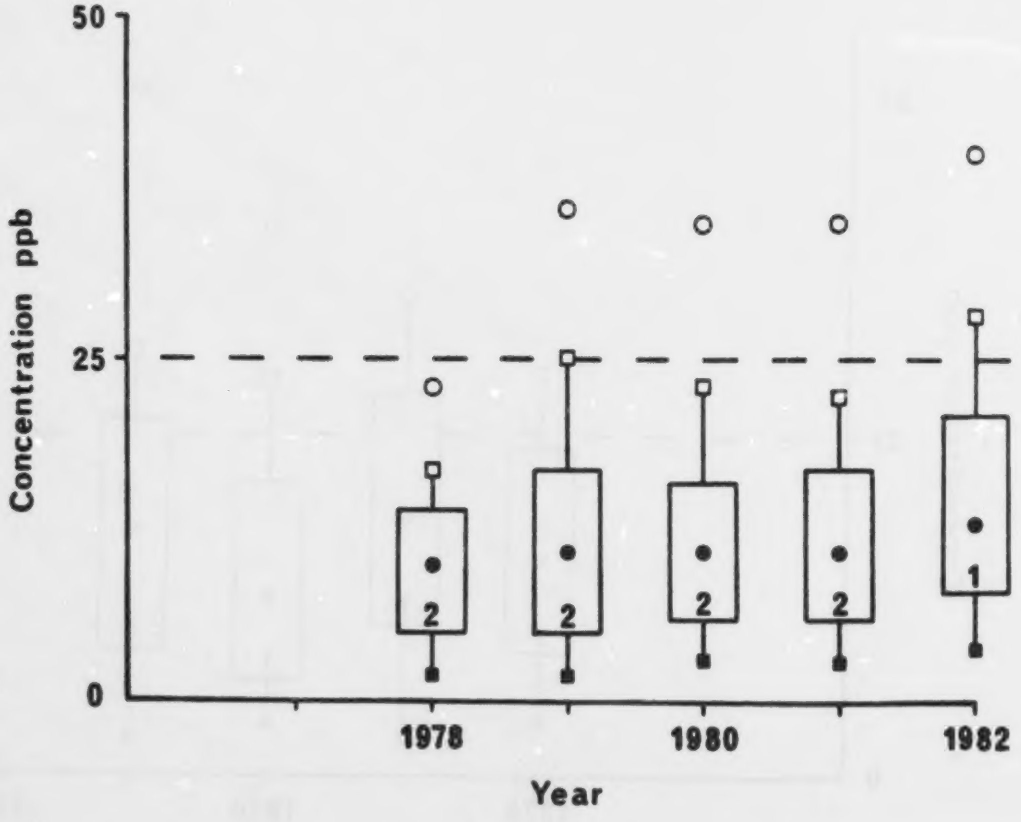


FIGURE: 3.17d Edmonton; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average O_3 Concentrations



(except in 1980 when no exceedances were recorded). There were more exceedances of the air quality objectives at the residential station(s) than at the nonresidential stations.

The composite monthly mean ozone concentrations (see Appendices I3.1 to I3.3) show the familiar regular pattern of highest levels between April and June except for the year 1981 when August had the highest composite annual mean (for each grouping of stations).

3.5.4 Edmonton: Total Hydrocarbons.

The composite annual mean THC levels for the three groupings of Edmonton stations are illustrated in Figure 3.18a. It should be noted that in 1974 and 1975, the data recovery was low (22.5 and 46.2 % for all stations) and this may account for the relatively high composite annnual means in those years.

The trends in the data (for 1976 and subsequently) show little change except for the residential station where the annual mean increased from 1976 to 1980. See box plots in Figures 3.18b to 3.18d.

The maximum hourly levels recorded in Edmonton were high and ranged from 7.7 to 99.8 ppm.

FIGURE: 3.18a Edmonton Stations: Composite Annual Means of the houly THC Concentrations

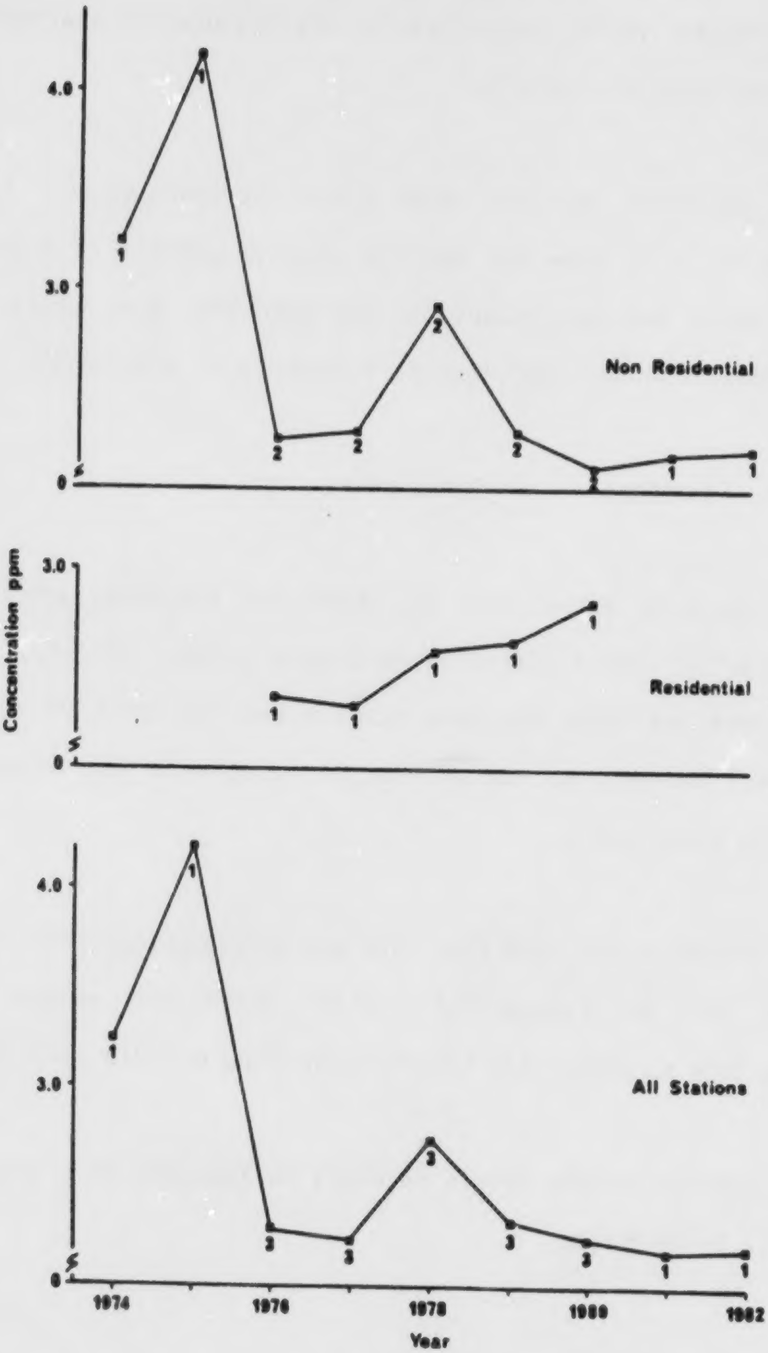


FIGURE 3.18b Edmonton; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average THC Concentrations

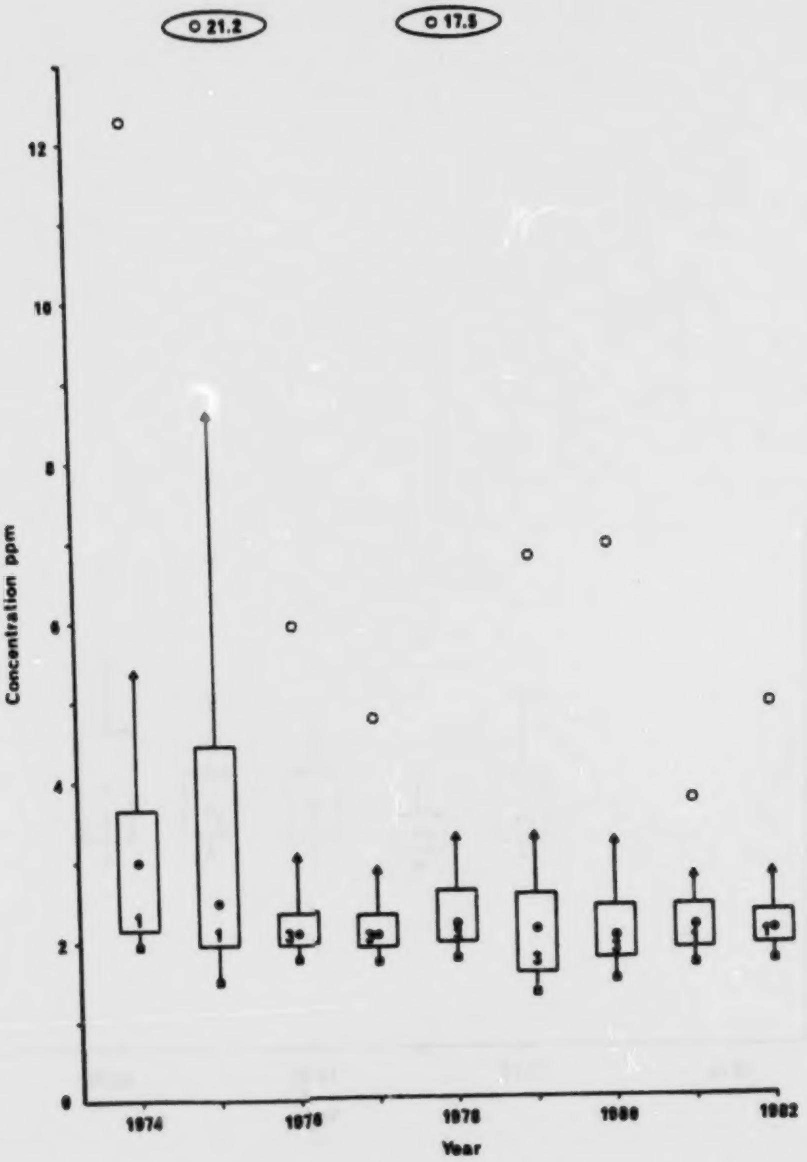


FIGURE: 3.18c Edmonton; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average THC Concentrations

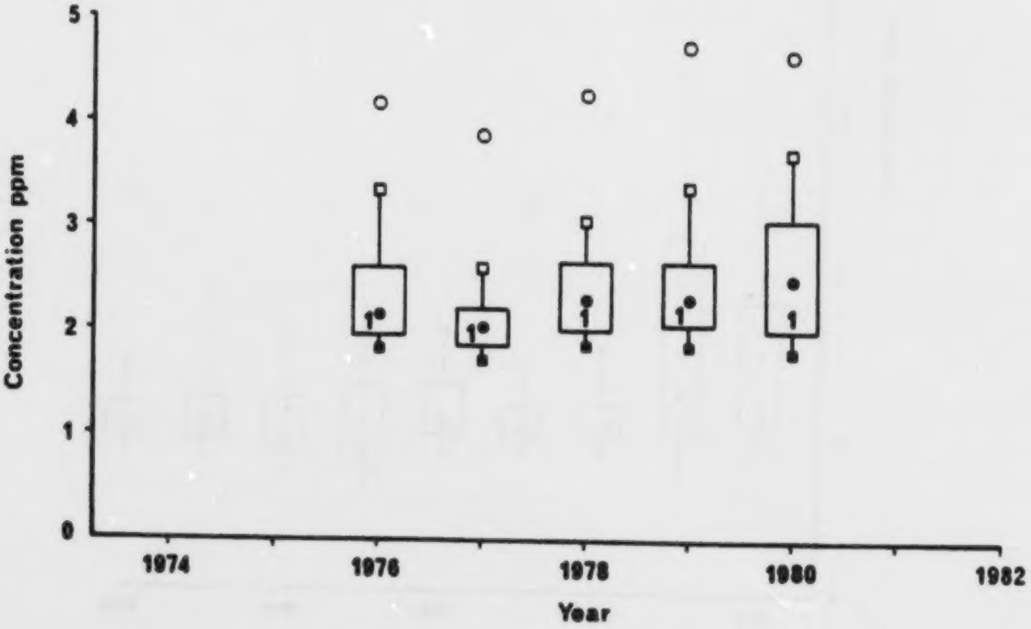
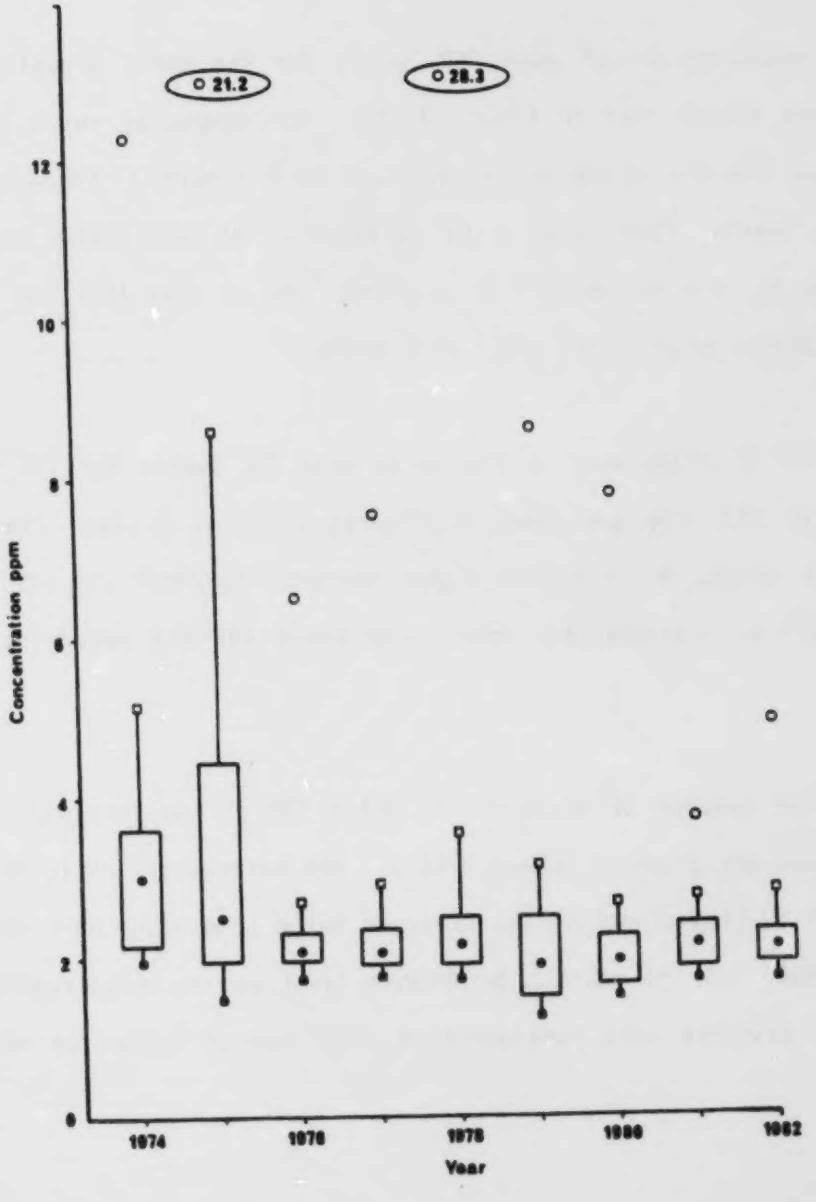


FIGURE: 3.18d Edmonton; Nonresidential Stations: Box Plot for the Annual Frequency Distributions of 24 hour Average THC Concentrations



The monthly mean values tended to be higher in the colder months (see Figures in Appendices I4.1 to I4.3) but this was not a consistent pattern.

3.5.5 Edmonton: Total Suspended Particulates

Composite annual mean TSP levels for the three groupings of stations are illustrated in Figure 3.19a. The composite annual (geometric) mean for all groupings of stations show a general tendency for increasing levels after 1971. The relatively low mean value in 1978 (expecially for the nonresidential stations) and in 1981 (for the residential stations especially) broke this trend.

The distributions of the daily mean TSP levels for the three groupings of stations are shown in Figures 3.19b to 3.19d. The concentrations corresponding to the higher percentiles (90th and 99th) for the residential stations are lower than those for the nonresidential stations.

The numbers of occasions on which TSP air quality objectives were exceeded are given in Appendix E5.3. The maximum tolerable 24 hour average air quality objective was exceeded twice (one occurrence each in 1976 and 1980) but the maximum acceptable level was exceeded regularly. Taking all stations into consideration, the average number of exceed-

FIGURE: 3.19a Edmonton Stations: Composite Annual Means of the 24 hour Average TSP Concentrations

Dashed line indicates the National maximum acceptable air quality objective level for the annual geometric mean TSP concentration.

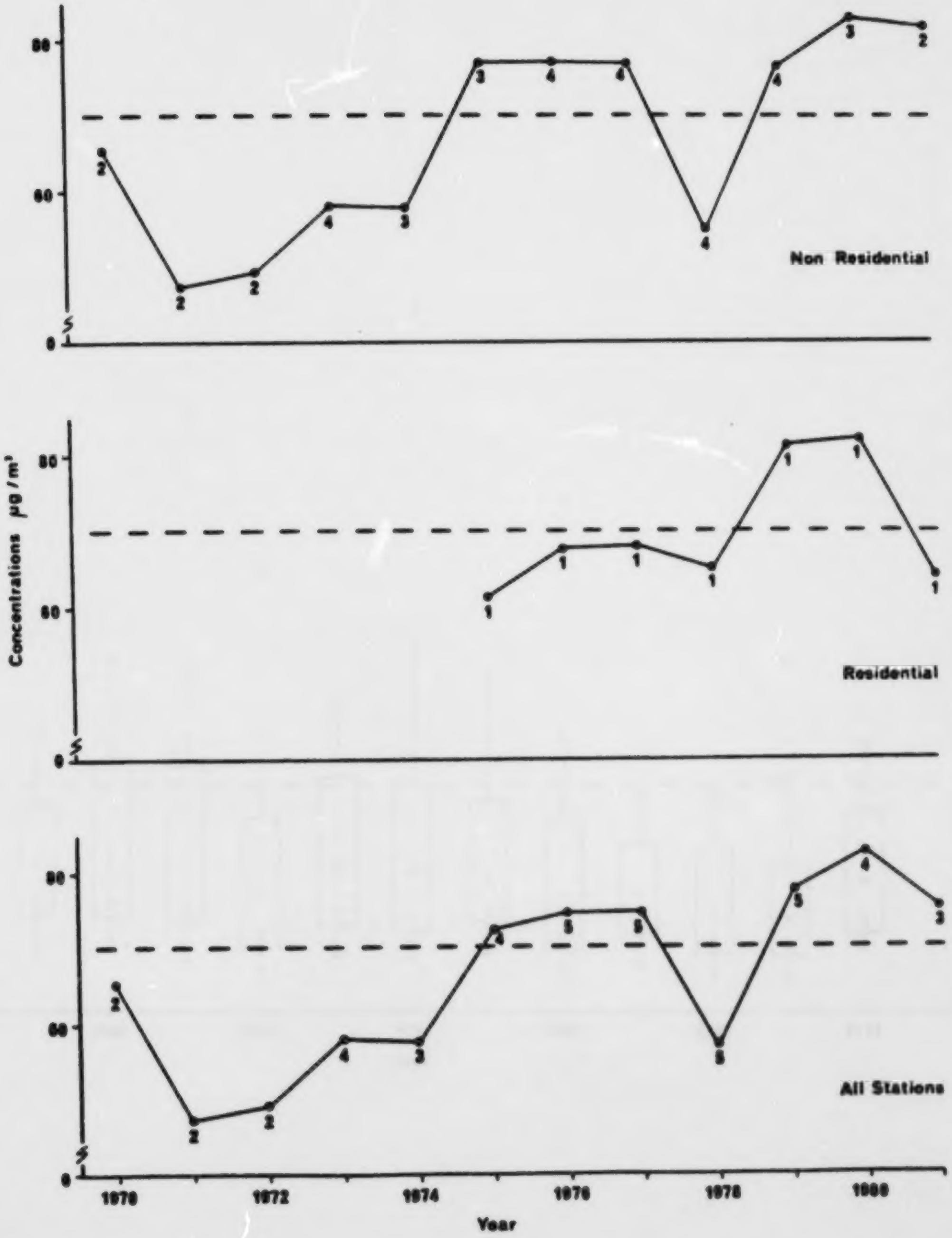


FIGURE 3.19b Edmonton; All Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations

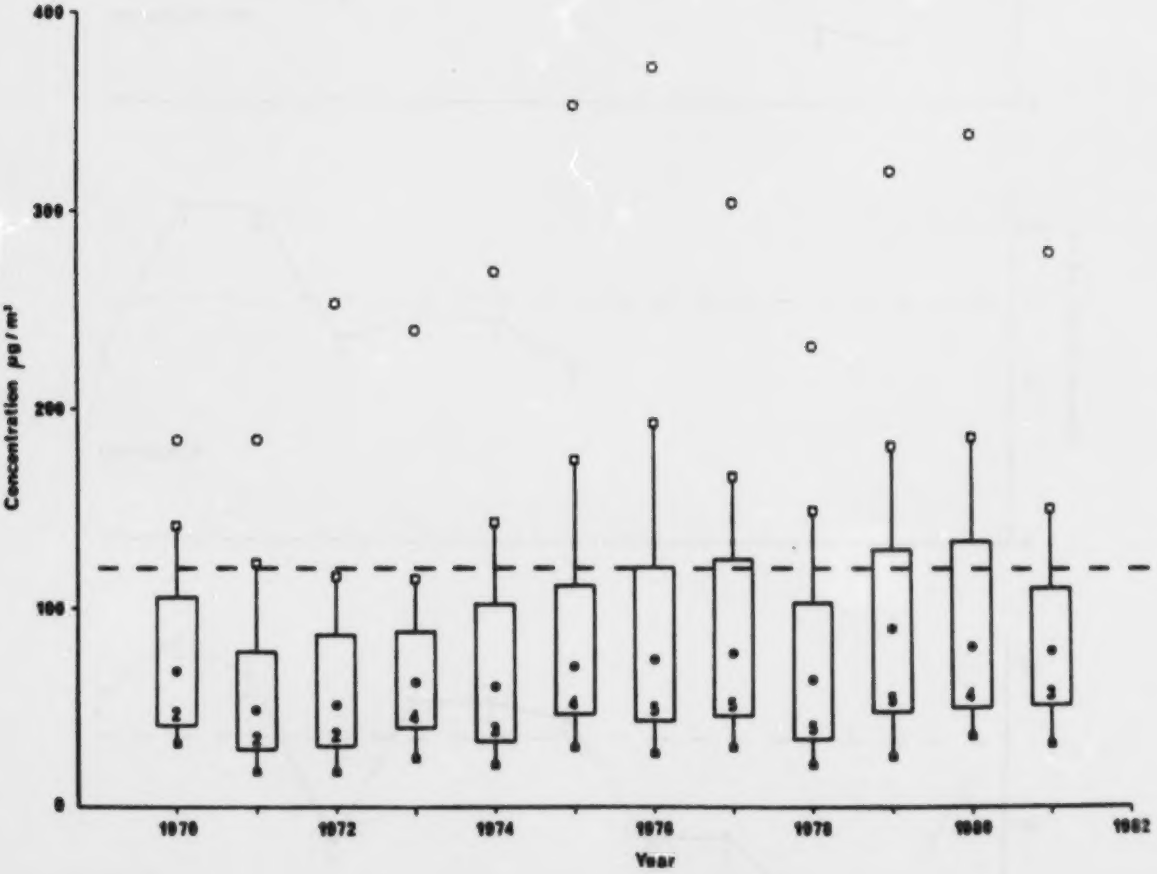


FIGURE 3.19c Edmonton; Residential Station: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations

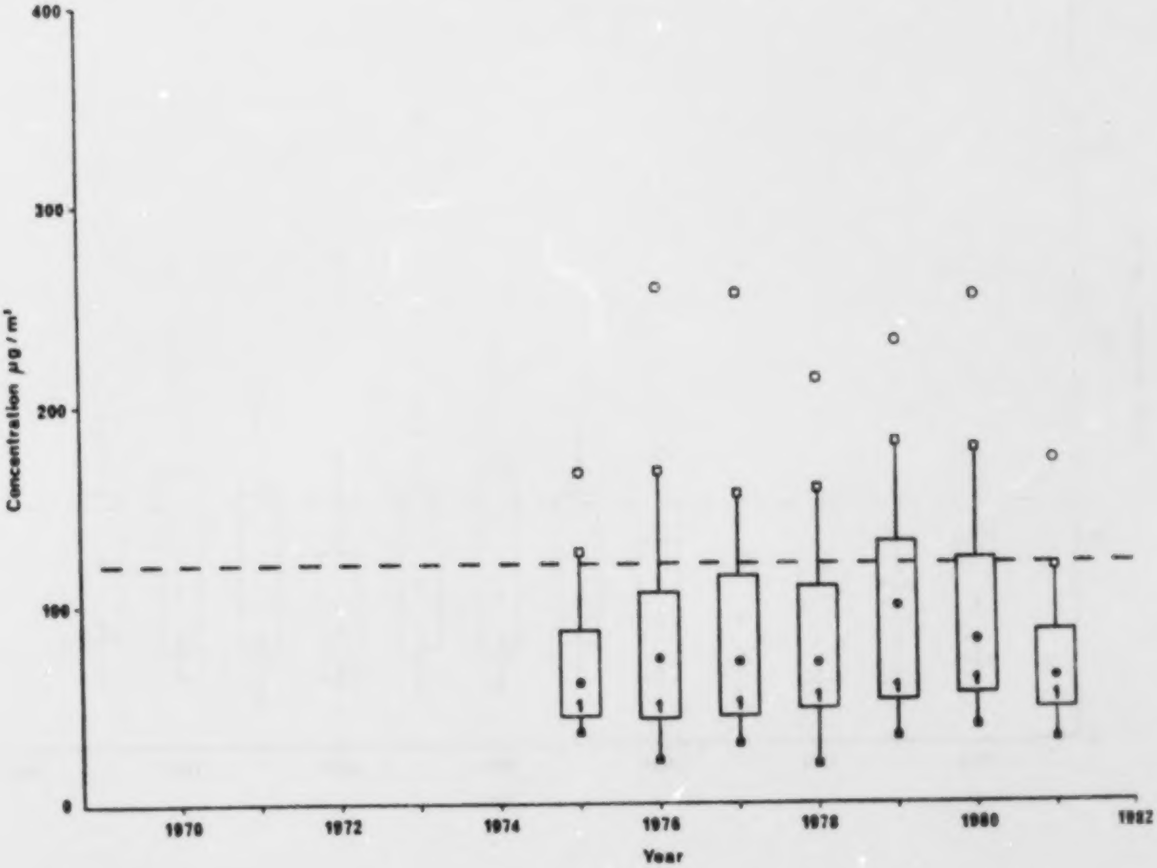
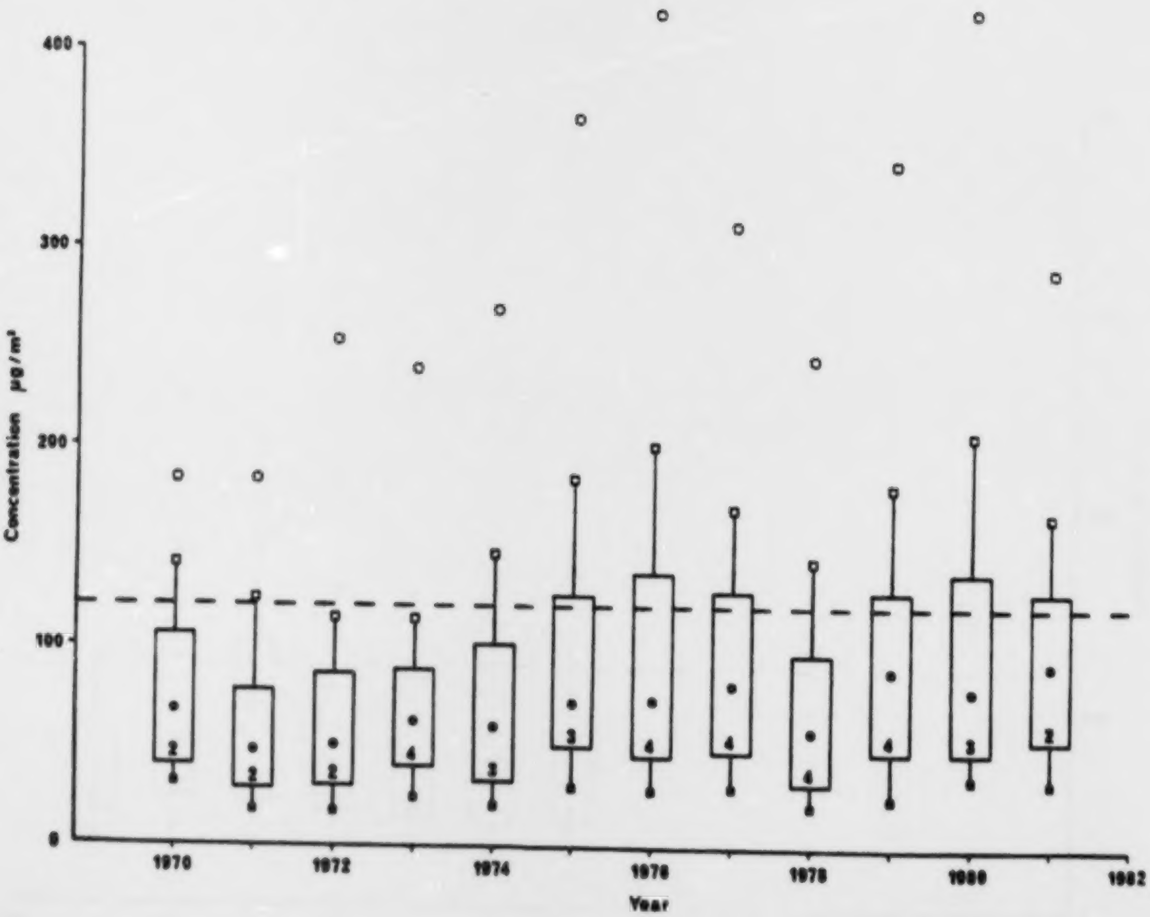


FIGURE: 3.19d Edmonton; Nonresidential Stations: Box Plots for the Annual Frequency Distributions of 24 hour Average TSP Concentrations



ances per station ranged from 4 to 15.5 each year. The majority of exceedances of the maximum acceptable 24 hour objective occurred at the nonresidential stations.

The variations of the composite monthly mean TSP levels are given in Appendix I5.1 to I5.3. The lowest levels are consistently shown in months of December and January but the month in which the highest levels occur each year varies.

3.6 Summary of Air Quality Trends

The overall trends in the pollutant levels in the 4 cities are described in this section in terms of the following:

a) Overall trends for each pollutant
b) Overall trends in cities
c) Comparisons between the residential and non-residential grouping of stations
d) Cyclical patterns for each pollutant

a) Overall Trends for Each Pollutant

The foregoing data analysis provided tabulations and plots of composite monthly and annual mean concentrations for each pollutant in each city. The composite means were based on three groupings of stations in each city, namely all stations, residential stations and nonresidential stations. A convenient manner of summarizing these data and providing some qualitiative indication of overall trends, is to fit a simple linear equation to the composite annual means. The selection of an averaging time of one year for the linear regression will eliminate the shorter term cyclical patterns (daily, weekly or seasonal variations) in pollutant concentrations. Examination of the composite monthly means will provide indication of seasonal or other cyclical patterns in the pollutant concentrations.

The linear equation provides a quantitative measure of the overall trends in the composite annual means for the period of observation. The slopes (m), the standard error in the slopes (s) and the correlation coefficients (R) of the regression analyses are given in Table 3.1.

A positive slope indicates an overall increase in the composite means and a negative slope a decrease in the composite annual means. The standard error in the slope s, refers to the 68 % confidence level that the slope lies between m + s and m - s.

The correlation coefficient of the regression by definition will have the same sign as the slope and it is a measure of the goodness of fit of the relationship. A correlation coefficient close to ± 1 indicates that the trend is significant. A correlation coefficient

TABLE 3.1

LINEAR REGRESSION PARAMETERS FOR COMPOSITE ANNUAL MEAN POLLUTANT CONCENTRATIONS FOR VARIOUS GROUPINGS OF STATIONS IN TORONTO, MONTREAL, VANCOUVER AND EDMONTON

City	Pollutant	Regression Parameters for Each Station Grouping					
		All Stations		Residential		Non-Residential	
		Slope*	R[#]	Slope*	R	Slope*	R
Toronto	CO	- 0.24 ± 0.04[£]	- 0.91	- 0.25 ± 0.04	- 0.89	- 0.25 ± 0.04	- 0.92
	NO_2	- 0.76 ± 0.36	- 0.65	- 2.07 ± 0.49	- 0.87	- 0.46 ± 0.35	- 0.47
	O_3	- 0.95 ± 0.28	- 0.81	0.10 ± 0.55	0.08	- 1.10 ± 0.28	- 0.85
	THC	- 0.02 ± 0.01	- 0.57	- 0.06 ± 0.03	- 0.56	- 0.01 ± 0.01	- 0.22
	TSP	- 2.99 ± 0.68	- 0.81	- 2.73 ± 0.57	- 0.84	- 3.41 ± 0.77	- 0.82
Montreal	CO	- 0.05 ± 0.02	- 0.80	+ 0.02 ± 0.02	+ 0.50	- 0.20 ± 0.02	- 0.97
	NO_2	- 2.59 ± 0.04	- 0.98	- 5.41 ± 1.54	- 0.93	- 0.68 ± 0.13	- 0.97
	O_3	0.87 ± 0.76	0.63	0.43 ± 0.68	0.41	1.30 ± 0.99	0.68
	TSP	- 5.15 ± 1.19	- 0.82	- 5.95 ± 1.20	- 0.86	- 3.24 ± 1.15	- 0.69
Vancouver	CO	0.04 ± 0.03	0.49	- 0.01 ± 0.03	- 0.14	0.04 ± 0.04	0.37
	NO_2	0.49 ± 0.33	0.72	0.91 ± 0.40	0.85	0.94 ± 0.17	0.97
	O_3	0.64 ± 0.35	0.74	- 0.02 ± 0.43	- 0.03	1.15 ± 0.26	0.95
	TSP	- 2.42 ± 0.84	- 0.67	- 2.74 ± 0.80	- 0.73	- 0.04 ± 1.19	- 0.01
Edmonton	CO	0.02 ± 0.02	0.23	0.04 ± 0.04	0.39	0.03 ± 0.03	0.30
	NO_2	- 0.45 ± 0.51	- 0.36	0.32 ± 0.86	0.17	- 1.82 ± 0.83	- 0.70
	O_3	0.52 ± 0.29	0.72	- 0.03 ± 0.98	- 0.02	1.04 ± 0.28	0.91
	THC	- 0.17 ± 0.07	- 0.68	0.09 ± 0.05	0.76	- 0.18 ± 0.07	- 0.68
	TSP	2.35 ± 0.72	0.72	1.81 ± 1.54	0.47	2.55 ± 0.82	0.70

*Units of ppm/year for CO and THC
ppb/year for NO_2 and O_3
μg/(m^3 year) for TSP

[#] Correlation coefficient

[£] Standard error in slope

close to zero indicates no significant relationship between the composite annual mean and time. The correlation coefficient disregarding the sign will be denoted as $|R|$.

Trends in TSP Levels

There were overall decreases in TSP levels in Toronto, Montreal and Vancouver as indicated by the slopes for the All Stations grouping in these cities. The correlation coefficients were large (and negative, $|R| > 0.67$), indicating a well defined downward trend in TSP levels. The average annual decreases in these cities were 2.99, 5.15 and 2.42 μg m^{-3} for Toronto, Montreal and Vancouver respectively. By and large, the trends to lower TSP levels occurred at both the residential and nonresidential groupings of stations in these cities with the exception of the nonresidential stations in Vancouver where the decrease was small (-0.04 μg m^{-3} $year^{-1}$) and the correlation coefficient was very low ($R = -0.01$).

In Edmonton, the TSP levels increased by an average of 2.35 μg m^{-3} each year.

Trends in CO Levels

There were no significant changes or trends in CO levels. In Toronto, there were average decreases in CO levels of about 0.2 ppm per year for all groupings of stations and the correlation coefficients were high ($|R| > 0.9$). CO levels in Montreal and Vancouver showed no consistent or significant changes since the slopes were usually low and had differing signs for different groupings of stations. In Vancouver, all three groupings of stations showed small overall increases in CO levels but the correlation coefficients were low ($|R| < 0.4$).

Trends in NO_2 Levels

There were consistent overall decreases in NO_2 levels in Toronto and Montreal (negative slopes for all groupings of stations) and the average decreases ranged from 0.46 to 5.4 ppb/year. The correlation coefficients were generally high ($|R| > 0.47$). It should be noted however, that there were only four years NO_2 data in Montreal and seven or eight years NO_2 data for Toronto stations.

The NO_2 levels in Vancouver showed an overall increase over the four year period. These average increases ranged from 0.49 to 0.91 ppb per year with reasonably high correlation coefficients (0.72 to 0.97).

In Edmonton, NO_2 levels at all stations and at the nonresidential stations showed overall average decreases of 0.45 and 1.8 ppb/year respectively but the correlation coefficients were -0.36 and -0.70 respectively. NO_2 levels at the residential station in Edmonton increased (slope of 0.32 ppb/year) but this trend was not significant (R = 0.17).

Trends in Ozone Levels

As was the case for NO_2 levels, four years ozone data are available for Montreal and Vancouver, four to five years in Edmonton and up to eight years in Toronto.

The only consistent trend in ozone levels occurred in Montreal where for all groupings of stations, the composite mean annual ozone levels showed increases ranging from 0.4 to 1.3 ppb per year. The correlation coefficients were 0.63, 0.41 and 0.68 for all stations, residential stations and nonresidential stations respectively.

In Vancouver and Edmonton, ozone levels tended to increase for all stations and for the nonresidentail stations (slopes were positive and correlation coefficeints in the range 0.7 to 0.95). In these cities, the ozone levels at the residential stations showed no significant trend (very small correlation coefficients).

In Toronto, there was no significant trend in ozone levels at the single residential station (R = 0.08). There were overall decreases of 0.95 ppb per year (all stations) and 1.10 ppb per year (nonresidential stations) and the correlation coefficients were high (-0.81 and -0.85 respectively). It should be noted, however, that ozone levels were unusually high in 1974 and 1975 and the large decrease in ozone levels between 1975 and 1976 is responsible for the observed overall decreasing trend.

Trends in THC Levels

THC data are available only in Toronto (11 years data) and Edmonton (5 to 9 years data). The slopes of the regressions were all low indicating no discernible upward or downward trend in THC levels in either city.

b) Overall Trends in Cities

The most consistent trend - towards general improvement in air quality, occurred in Toronto as evidenced by the negative slopes and generally high correlation coefficients. It is only in the case of ozone at the (single) residential station that this general trend was not followed (a small positive slope but poor correlation coefficient of 0.08). In Toronto, (considering all stations), THC is the pollutant whose trend towards lower levels is weakest (with a low slope of -0.02 ppm/year and a correlation coefficient of -0.57).

The general overall trends in the other three cities were mixed. In Montreal for example, NO_2 and TSP showed trends to lower levels; in Vancouver, only TSP showed improvement while in Edmonton, NO_2 showed some improvement at the nonresidential stations.

c) Comparisons Between Residential and Nonresidential Stations

The distinction between the residential and nonresidential grouping of stations was reflected in the majority of cases by lower pollutant levels at the residential stations. In Montreal, Vancouver and Edmonton however, the ozone levels at the residential stations were generally higher than those at the nonresidential stations while in the case of NO_2, the converse was the case. The presence of NO_2 can be taken to imply significant NO levels as well and the rapid reaction of ozone with NO would therefore serve to reduce the measured ozone concentrations. The higher NO_2 levels and lower O_3 levels at the nonresidential stations than at the residential stations are therefore consistent with the station groupings.

The TSP levels at the residential stations in Edmonton and Vancouver on average were slightly above those at the nonresidential stations. Another case in which the levels at the residential stations tended to be higher than those at nonresidential stations was for CO in Vancouver. In these two cases it is likely that the residential stations in question were influenced by significant sources of CO and particulates respectively.

d) Cyclic Patterns for Each Pollutant

The seasonal or other temporal cyclical patterns in the pollutant levels were indicated in the plots of the various composite monthly means (see Appendices F, Volume II for plots of composite monthly means). For CO, there were relatively weak patterns of higher levels in the colder months. This pattern was more evident in Vancouver and Edmonton and least evident in Toronto.

The NO_2 levels also had weak cyclical pattern in which highest monthly means occurred between January and March. In Vancouver, however, there were indications of NO_2 levels peaking in September to October as well.

Ozone levels exhibited a very strong and well defined cyclical pattern in which highest levels occurred between May and July and minimum levels occurred in October through December. This pattern is consistent with the photochemical basis for ozone production since it is similar to the variation of solar intensity throughout the year. The ozone levels peaked slightly earlier in Vancouver (April - May) than in the other cities.

The THC levels in Edmonton and Toronto did not show any well defined cyclical pattern. The levels in Edmonton were highly variable and generally higher than in Toronto.

TSP levels were generally lowest in the colder months - a pattern most noticeable in Edmonton where the differences between the highest and the lowest monthly means were greatest.

4. EMISSION INVENTORY

Emission inventory data for 1978 were assembled for the four cities involved in this study. Raw data motor vehicles i.e. emission factors, were obtained from the Transportation Systems Division (TSD) of the Industrial Programmes Branch and the balance was supplied from the National Emission Inventory System (NEIS). Note that NEIS data relate to census management areas, rather than to cities. These data therefore represent an upper limit to the city emissions. The emission inventories are presented in Tables 4.1 to 4.4.

In assessing the ozone forming potential of emissions, a breakdown of VOCs by reactivity class is required. Examples of this breakdown for 1978 are presented in Tables 4.5 to 4.8. The reactivity classes are:

- paraffins
- olefins
- aldehydes
- aromatics

which are representative of those used in many photochemical models (e.g., Demerjian and Schere, 1978). Species not falling into one of the four classes listed above were treated as unreactive. The quantities concerned were generally small, except where considerable quantities of methane (considered non-reactive) are emitted.

TABLE 4.1

Emission Inventory (metric tonnes/yr): Toronto

Toronto	1978		
Source Sector	VOC	NO_x	CO
LDV	70,297	45,228	737,267
Other mobile	26,672	54,352	252,403
Stationary	79,540	65,945	89,360
Total	176,509	165,525	1,079,030

TABLE 4.2

Emission Inventory (metric tonnes/yr): Montreal

Montreal	1978		
Source Sector	VOC	NO_x	
LDV	61,617	35,335	640,044
Other mobile	20,708	52,129	156,757
Stationary	142,184	54,945	151,579
Total	224,509	142,409	948,380

TABLE 4.3

Emission Inventory (metric tonnes/yr): Vancouver

Vancouver		1978	
Source Sector	VOC	NO_x	CO
LDV	35,995	23,401	382,710
Other mobile	19,085	31,555	218,332
Stationary	40,608	13,893	53,797
Total	95,688	68,849	654,839

TABLE 4.4

Emission Inventory (metric tonnes/yr): Edmonton

Edmonton		1978	
Source Sector	VOC	NO_x	
LDV	18,734	12,247	200,623
Other mobile	16,826	37,770	186,654
Stationary	33,501	19,710	27,329
Total	69,061	69,727	414,606

TABLE 4.5

Breakdown of VOC Emissions by Chemical Class

Toronto

(1978 data, 10^3 tonne/year)

Source Sector	Paraffins	Olefins	Aromatics	Ketones/Aldehydes	Other	Total
LDV	31.8	15.2	13.1	2.5	7.8	70.3
Other mobile	11.6	6.1	4.5	1.5	3.0	26.7
Stationary	15.6	2.8	4.7	4.2	52.2	79.5
TOTAL	59.0	24.1	22.3	8.2	63.0	176.5

TABLE 4.6

Breakdown of VOC Emissions by Chemical Class

Montreal

(1978 data, 10^3 tonne/year)

Source Sector	Paraffins	Olefins	Aromatics	Ketones/Aldehydes	Other	Total
LDV	27.9	13.3	11.4	2.2	6.8	61.6
Other mobile	9.6	4.6	3.2	1.2	1.9	20.7
Stationary	26.4	6.8	9.9	7.0	92.5	142.2
TOTAL	63.9	24.7	24.5	10.4	101.2	224.5

TABLE 4.7

Breakdown of VOC Emissions by Chemical Class

Vancouver

(1978 data, 10^3 tonne/year)

Source Sector	Paraffins	Olefins	Aromatics	Ketones/Aldehydes	Other	Total
LDV	16.2	7.8	6.7	1.2	4.0	36.0
Other mobile	8.0	4.5	3.4	1.0	2.3	19.1
Stationary	6.9	2.8	3.7	1.8	25.5	40.6
TOTAL	31.1	15.1	13.8	4.0	31.8	95.7

TABLE 4.8

Breakdown of VOC Emissions by Chemical Class

Edmonton

(1978 data, 10^3 tonne/year)

Source Sector	Paraffins	Olefins	Aromatics	Ketones/Aldehydes	Other	Total
LDV	8.4	4.1	3.5	0.6	2.1	18.7
Other mobile	7.1	3.9	2.8	1.0	2.0	16.8
Stationary	11.9	0.8	1.2	1.3	18.3	33.5
TOTAL	27.4	8.8	7.5	2.9	22.4	69.1

4.1 Projections of Emission Inventories

In previous studies, emission inventory projections have been based on a sector by sector analysis of expected growth rates (Concord Scientific Corporation, 1982; Concord Scientific Corporation, 1983). Specifically, scaling for expected population growth was applied to the following source sectors: bakeries, dry cleaning, fuelwood combustion, residential heating, landfill sites, solid waste incineration, structural fires, motor cycles and snowmobiles. Population data and projections were obtained from appropriate local government data summarised by the Financial Post (1981).

Emissions from the following sectors were assumed to scale with economic growth: application of surface coatings, crude oil production, diesel and gasoline marketing, clay products production, power generation, commercial and industrial fuel combustion, general solvent use, plastics fabrication, and all of the point source categories except municipal incineration and petroleum refining. Having made this assumption, it is extremely difficult to proceed further, since the present state of the world and Canadian economies virtually precludes the estimation of economic trends. The assumption was therefore made that employment is a measure of the state of the economy. Employment data and projections were obtained from Financial Post (1981).

Information on rail, marine and aircraft sources was obtained from Transport Canada (Economic Analysis Directorate, 1983).

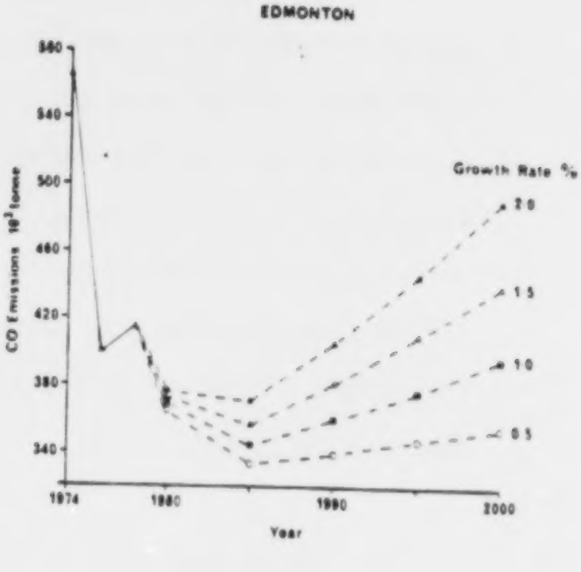
Emissions of VOCs from refinery operations in most areas have decreased substantially between 1973 and 1978, as a result of improved hydrocarbon control programs (PACE, 1980). This downward trend was expected to continue, but has not yet been quantified (PACE, 1983). The same source reveals a reduction of approximately 15 % in refinery NO_x emissions for the same period. In the absence of any firm projections for this sector, the only adjustment made was for refinery closures. For example, three refineries have been (or shortly will be) closed in Montreal (PACE, 1983).

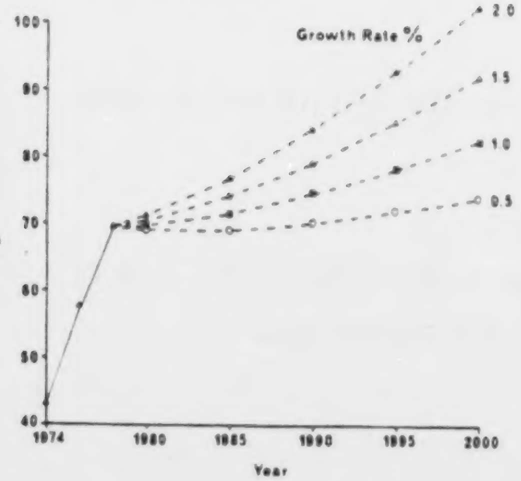
Projections carried out in this way predict growth rates in the range of 0.5 to 2.0 percent for total emissions for the four study cities. Because of the uncertainties inherent in the projections, a range of growth scenarios (0.5, 1.0, 1.5 and 2.0 percent per year) was used in the prediction of total emissions for this study. The predicted emissions for NO_x, VOC and CO are shown in Figures 4.1 to 4.4. To put these in perspective, the emissions for 1974, 1976 and 1978 are also included in the figures.

The detailed procedures used in the calculation of these emissions are given below.

The 1978 total emissions are as given in Tables 4.1 to 4.4. The 1974 and 1976 data were also obtained from TSD and NEIS.

igure 4.1 Emission Inventory
Trends, 1974 - 2000: Edmonton





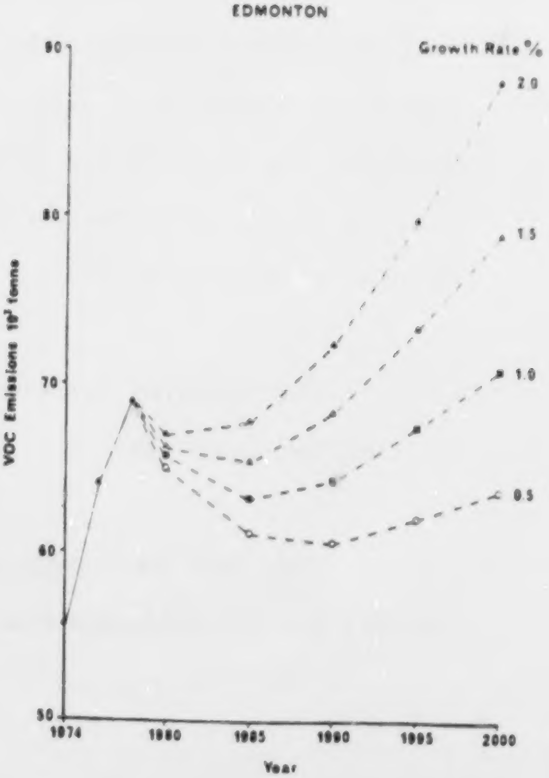
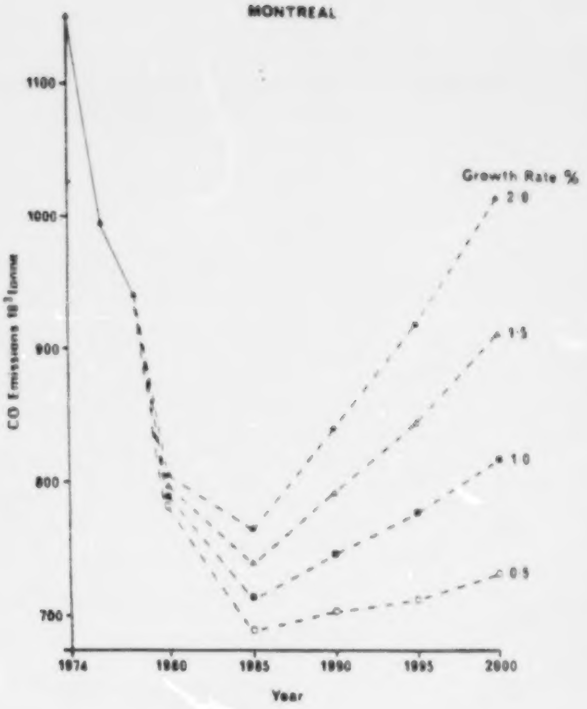
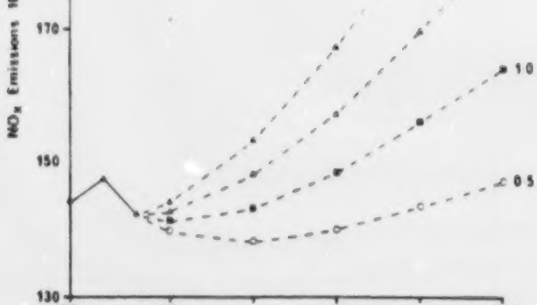


Figure 4.2 Emission Inventory Trends, 1974 - 2000: Montreal





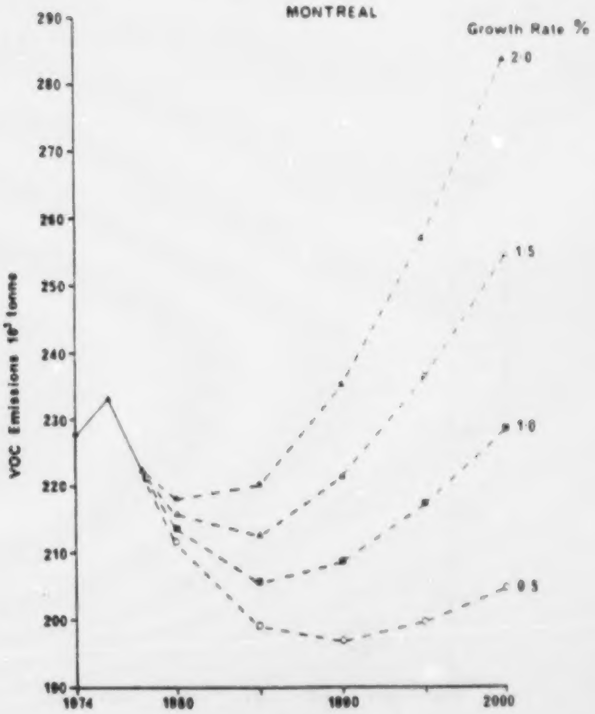
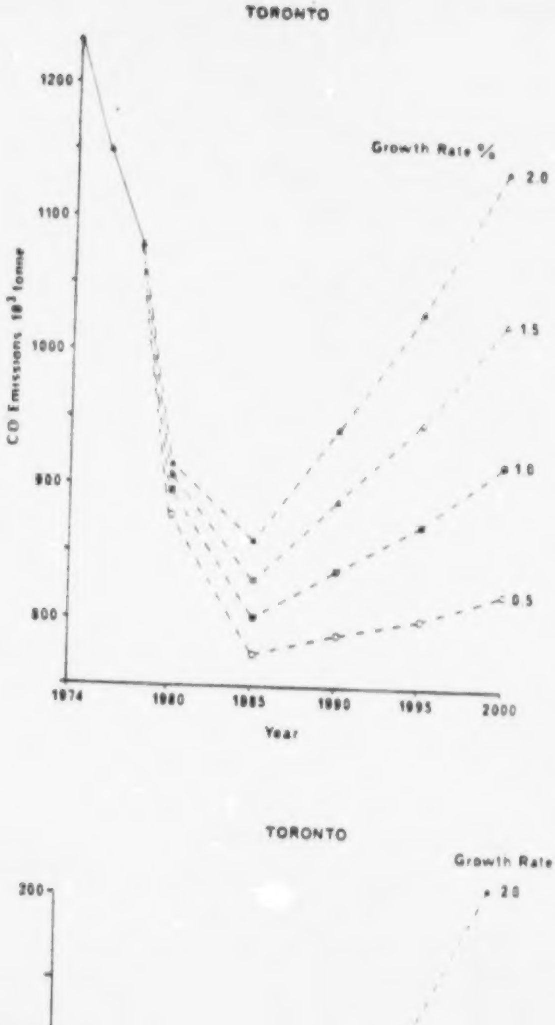
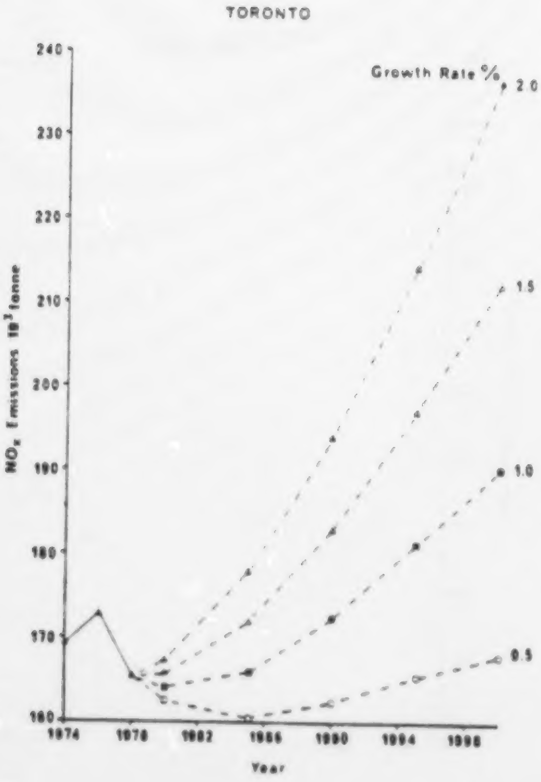


Figure 4.3 Emission Inventory Trends, 1974 - 2000: Toronto





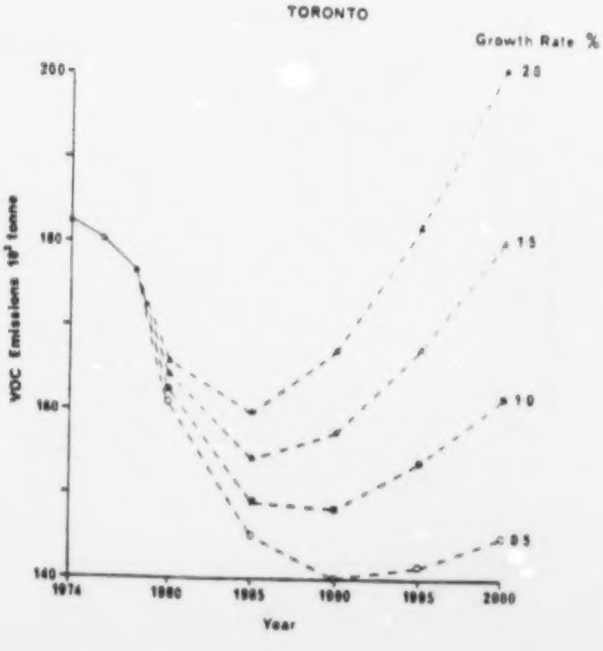
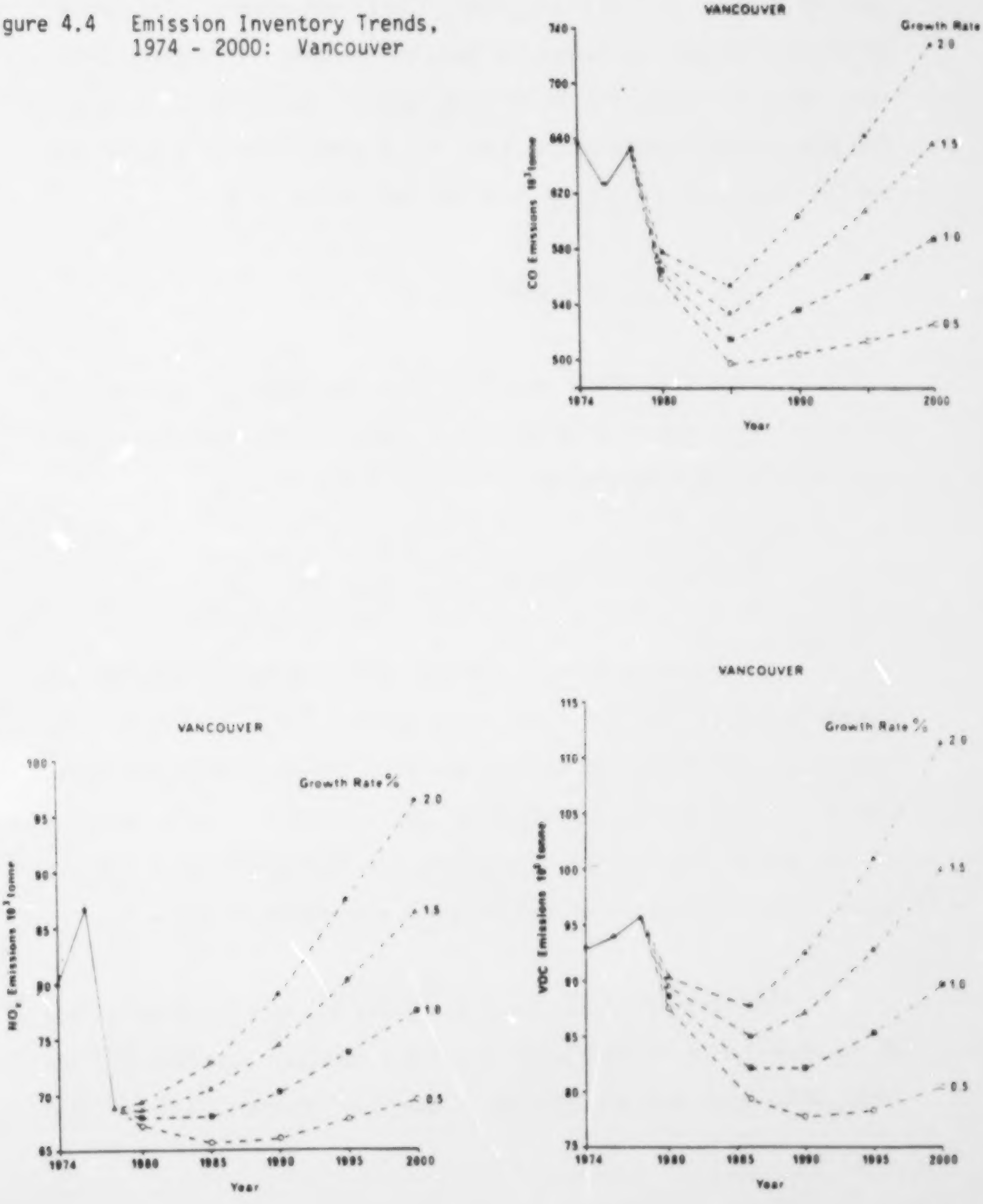


Figure 4.4 Emission Inventory Trends, 1974 - 2000: Vancouver



The 1978 emissions were broken down to those from light duty vehicles (LDV, i.e., cars and light trucks) and others. The "other" emissions were then projected by applying to them the relevant growth rate, assuming no changes in emission control regulations. Note that the growth rate is compounded, i.e., for a growth rate of g % per year the 1980 emissions are derived from the 1978 emissions as

$$E_{1980} = E_{1978} (1 + g/100)^2 .$$

In the case of LDV emissions it is the number of vehicle miles travelled (VMT) which is projected as above. This quantity is then combined with the projected emission factor (EF). That is

$$\text{LDV emissions} = \text{VMT} \times \text{EF} .$$

The projected emission factors were supplied by TSD, and are composite values for the fleet as a whole. They, therefore, take account of such factors as vehicle age distribution through the fleet, typical driving cycle, deterioration and tampering. These emission factors assume that current regulations are maintained for all future years. The actual values of the factors are presented in Table 4.9.

The total emissions shown in Figures 4.1 to 4.4 are calculated as the combination of two factors showing a monotonic increase (VMT and other emissions) and one showing a monotonic decrease (LDV emission

TABLE 4.9

PROJECTED VEHICLE EMISSION FACTORS (g $mile^{-1}$)

	1980			1985			1990			1995 and 2000		
	NO_x	HC	CO	NO_x	HC	CO	NO_x	HC	CO	NO_x	HC	CO
Cars	2.80	3.78	36.22	2.42	2.32	28.79	2.31	1.78	29.11	2.31	1.63	28.52
Light Duty Trucks	3.75	3.97	54.97	3.03	2.58	31.72	2.65	2.21	26.94	2.65	2.21	26.94

factor). The result is that the total emissions pass through a minimum with increasing time.

The depth of this minimum, and the extent to which the emissions increase thereafter, depends on a number of factors, such as:

- the growth rate,
- the extent to which the emission factors decrease with time,
- the relative contribution of LDV emissions to the total.

These factors will be discussed further in Section 5, in which a qualitative assessment of the effect of changing emissions will also be made.

5. FUTURE EMISSIONS AND THEIR IMPACT ON AIR QUALITY

The expected future emissions of CO, NO_x and VOC are discussed below, city by city, with a qualitative discussion - as specifically requested in the terms of reference for the contract, of the possible effect on air quality in each city. This discussion is based on the premise that there is a direct connection between annual emissions of a pollutant, and its annual average concentation. This premise is tested by comparing the 1974, 1976 and 1978 emissions data summarised in Figures 4.1 to 4.4, with the air quality data summaries contained in Chapter 3.

There is qualitative concordance between emissions and concentrations for CO, NO_2 and hydrocarbons in Toronto and for CO in Montreal, in the sense that the two quantities increase or decrease in concert. There is less agreement for Edmonton, while the comparison can not be made for NO_2 and THC in Montreal, due to a lack of air quality data, and is difficult in Vancouver for the same reason.

The lack of a one to one correspondence between emissions and air quality is largely the result of the important role played by meteorological factors in determining atmospheric concentrations. Where possible, this is addressed using a mathematical model to take account of emissions, pollutant transport, dispersion and transformation. However, the qualitative approach used here was as requested in the terms of reference. It should be noted that city-specific emission inventory data are not available and appropriate calibrated urban photochemical models suitable for use in the cities of interest were not available.

5.1 Edmonton

Edmonton is rather different from the other cities studied here, in that automotive emissions are a relatively small contributor to the total. The actual fractional contribution is indicated in Table 5.1, and is independent of the growth rate.

For NO_x and VOC the fractional contribution decreases steadily from 0.21 and 0.37 in 1974 to 0.13 and 0.12 in 1990. Thereafter, the fractions remain constant because of the constancy of the emission factors. The CO fraction has a maximum value of 0.48 in 1978, declining to 0.33 in 1990 and thereafter.

The result is that the minimum in total emissions (Figure 4.1) is not as pronounced as in other cities. At the highest growth rates, significant (~ 20 %) increases in NO_x and VOC emissions are to be expected by 1995. Even at the highest growth rate, CO emissions in the year 2000 are expected to be significantly below the 1974 level. However, this level is significantly higher than those for 1976 and 1978.

TABLE 5.1

LDV CONTRIBUTION TO TOTAL EMISSIONS: EDMONTON

Year	LDV/TOTAL			VOC/NO_x Emissions
	CO	NO_x	VOC	
1974	0.35	0.21	0.37	1.29
1976	0.47	0.18	0.27	1.11
1978	0.48	0.18	0.27	1.00
1980	0.41	0.16	0.22	0.94
1985	0.34	0.14	0.15	0.88
1990	0.33	0.13	0.12	0.86
1995	0.33	0.13	0.12	0.86
2000	0.33	0.13	0.12	0.86

It should be noted that the projections given here indicate a substantially lower rate of overall growth in emissions than do the historical data (for NO_x and VOC at least). This is reasonable, in light of current economic difficulties. However, should Edmonton experience another economic boom, rather larger growth rates may be expected.

Expected effects on air quality are as follows:

i) CO: Carbon monoxide is essentially inert in the atmosphere: its concentration is, therefore, approximately proportional to the rate of emission; and assuming that the 1974 emission rate is correct, CO air quality for the forseeable future should not deteriorate relative to 1974 levels noting that these were particularly high. However, the improvements achieved in the period 1980-1985 will probably be reversed in subsequent years (see Figure 4.1).

ii) NO_x and VOC: These are reactive in the atmosphere. It is therefore, likely that ambient concentrations will increase less rapidly than do the emission rates. By 1995 NO_x levels may increase by zero to twenty percent over 1978 levels, while VOC concentrations will range between a five percent decrease and a ten percent increase.

iii) O_3: Ozone is formed in a non-linear series of reactions and it is difficult to predict what the effect on its concentration will be. In particular, concentrations may be expected to rise because both NO_x and VOC concentrations are expected to rise. However, this is offset by the declining ratio of VOC to NO_x emissions, also shown in Table 5.1. It is well established that decreasing this ratio causes ozone production to decrease (e.g., EPA, 1981).

It is, therefore, likely that ambient ozone concentrations will change very little during the next fifteen to twenty years.

5.2 Montreal

In Montreal, LDV emissions of CO and NO_x form a larger fraction of total emissions than is the case in Edmonton. Because of the concentration of petrochemical industries in Montreal, LDV emissions of VOC are lower relative to the total. The contribution of LDV emissions as a fraction of the total is given in Table 5.2

It can be seen from Table 5.2 that this LDV contribution declines to 0.22 for NO_x, 0.11 for VOC and 0.53 for CO. At the same time, however, significant increases in total emissions of NO_x and VOC are likely by 1995 (see Figure 4.2). Emissions of CO, however, are likely to remain lower than the 1974 and 1976 levels (for all but the 2 % growth rate) for the next twenty years.

TABLE 5.2

LDV CONTRIBUTION TO TOTAL EMISSIONS: MONTREAL

Year	LDV/TOTAL			VOC/NO_x Emissions
	CO	NO_x	VOC	
1974	0.68	0.26	0.37	1.58
1976	0.69	0.26	0.28	1.58
1978	0.67	0.28	0.27	1.58
1980	0.60	0.26	0.22	1.51
1985	0.54	0.23	0.15	1.44
1990	0.54	0.22	0.12	1.41
1995	0.53	0.22	0.11	1.39
2000	0.53	0.22	0.11	1.39

The implications for air quality are:

i) CO: It is likely that ambient CO levels will decline until 1985, returning gradually thereafter to current levels.

ii) VOC and NO_x: Ambient VOC and NO_x concentrations may increase by up to 10 or 15 % by 1995.

iii) O_3: Ambient ozone concentrations may also increase during this period. This is because the increase in VOC and NO_x emissions is accompanied by VOC to NO_x ratios which remain relatively high (see Table 5.2).

5.3 Toronto

Light duty vehicle emissions in Toronto in 1978 comprised 68 % of the total for CO, 27 % for NO_x and 40 % for VOC. These fractions are expected to decrease to 0.54 for CO, 0.21 for NO_x and 0.18 for VOC by 1990 or 1995 (Table 5.3).

As can be seen from Figure 4.3, the simple model used in this assessment suggests that, by 1995, total Toronto emissions of CO and VOC will equal or be below 1978 levels for all but the 2 % growth rate. Total NO_x emissions will, however, increase significantly in that time.

The implications for air quality are as follows:

TABLE 5.3

LDV CONTRIBUTION TO TOTAL EMISSIONS: TORONTO

Year	LDV/TOTAL			
	CO	NO_x	VOC	VOC/NO_x Emissions
1974	0.72	0.25	0.52	1.08
1976	0.66	0.25	0.40	1.04
1978	0.68	0.27	0.40	1.07
1980	0.61	0.25	0.33	0.99
1985	0.54	0.22	0.24	0.90
1990	0.54	0.21	0.19	0.86
1995	0.54	0.21	0.18	0.85
2000	0.54	0.21	0.18	0.85

i) Ambient concentrations of CO and VOC will probably remain at approximately current levels or slightly below.

ii) Significant increases in NO_x concentrations (up to 15 % or 20 %) are possible.

iii) Ambient ozone concentrations may actually decrease because of rising NO_x emi[illegible]ons and the declining VOC to NO_x emission ratio. This behaviour is a consequence of the relatively small contribution of LDV emissions to total NO_x emissions and results in a relatively large decline in the VOC to NO_x emission ratio over the same time period.

5.4 Vancouver

The fractional contributions of LDV emissions given in Table 5.4 indicate that motor vehicles are significant emitters in Vancouver. In 1978 the fractions were 0.58 for CO, 0.34 for NO_x and 0.38 for VOC. These fractions are expected to decline as current vehicle emission regulations become effective throughout the fleet, levelling off at 0.43 for CO, 0.27 for NO_x and 0.17 for VOC.

Figure 4.4 reveals that CO emissions will not return to 1978 levels until 1995 (even at the highest assumed growth rate). By that time total NO_x emissions will be up to about 30 % above the 1978 level. Only for VOC does there appear to be the possibility of an increase over 1978 levels, though it will probably be ten percent or less.

TABLE 5.4

LDV CONTRIBUTION TO TOTAL EMISSIONS: VANCOUVER

Year	LDV/TOTAL			VOC/NO_x Emissions
	CO	NO_x	VOC	
1974	0.65	0.25	0.49	1.16
1976	0.62	0.25	0.39	1.08
1978	0.58	0.34	0.38	1.39
1980	0.50	0.32	0.31	1.31
1985	0.43	0.28	0.22	1.21
1990	0.43	0.27	0.18	1.17
1995	0.43	0.27	0.17	1.16
2000	0.42	0.27	0.17	1.16

The implications for air quality are as follows:

i) CO and NO_x: Ambient concentrations of these species are unlikely to increase over 1978 values.

ii) THC: There may, however, be an increase in total hydrocarbon levels. This is confirmed by the indication in Table 5.4 that the VOC to NO_x emission ratio is likely to remain relatively high.

iii) O_3: Because of the increase in VOC and NO_x emissions and the expected continued high VOC to NOx ratio it is possible that ambient ozone concentrations in Vancouver will increase in the future.

5.5 Summary

A very simple set of projection scenarios have been applied to total emissions of CO, VOC and NO_x in Edmonton, Montreal, Toronto and Vancouver. The analysis suggests that increases in ambient air concentration may be observed in the next ten to fifteen years as follows:

Edmonton : NO_x, VOC
Montreal : NO_x, VOC, O_3
Toronto : NO_x
Vancouver: VOC, O_3

During this time period (1995 - 2000) the fractional contribution of LDV emissions to the total is expected to decline as older vehicles not meeting current standards are retired from the fleet. Since ozone is generally the pollutant of greatest concern over much of Canada, the fractional contribution of vehicular VOC emissions to the total is of particular interest. This fraction ranges from 0.12 (Edmonton), through 0.17 (Vancouver) to 0.18 (Toronto). These fractions suggest that current emissions standards will reduce vehicular VOC Contributions to total emissions. However, they fail to take into account the reactivity of the emitted VOC mixture. According to McCrae and Seinfeld (1983), vehicular organic emissions comprise 26 % of the total organic emissions of the Los Angeles area on a mass basis. However, when weighted for reactivity, this fraction rises to 78 %. If it is assumed that approximately the same proportionality exists for the Canadian cities, vehicles will eventually (by about 1990) emit 35 to 50 % of organic compounds on a reactivity weighted basis. It may then be necessary to control vehicular emissions more stringently.

The effect of such more stringent controls will be most marked in the case of VOCs since automotive emissions have high reactivity. The result will be a decrease in the VOC to NO_x ratio, which may be expected to bring about improvements in ozone levels. Although less marked in the case of other pollutants, it is nevertheless true that more stringent control of automotive emissions should give rise to an improvement in the ambient concentrations of the corresponding pollutants.

6. BIBLIOGRAPHY

City of Toronto, Department of Public Works. (1982). City of Toronto: Cordon Report 1970-1981.

Communauté Urbaine de Montréal, Office de l'Expansion Economique. (1982). Population Changes per Municipality in the Montreal Urban Community 1971/1976. September, 1982.

Communauté Urbaine de Montréal, Office de l'Expansion Economique. (1982). Economic Overview of Montréal.

Communauté Urbaine de Montréal, Office de l'Expansion Economique. (1982). Tables to Economic Overview of Montreal.

Concord Scientific Corporation. (1981a). Compressor Exhaust Chemistry and Wake Diffusion. Study - Phase I. An Annotated Bibliography of Chemistry, Flow and Dispersion in the Wake of Buildings. Report 110.67 for the Alberta Petroleum Industry Government Environmental Committee.

Concord Scientific Corporation. (1981b). Vancouver Oxidant Study Air Quality Analysis. Report 110.127 to Environmental Protection Service. DSS Contract #47SS KE145-1-0519.

Concord Scientific Corporation. (1983). Montreal-Quebec City Oxidants Study Report 110.255 to Environmental Protection Service. DSS Contract #47SS KE145-1-0483.

Environmental Protection Service, Air Pollution Control Directorate. (1972). An Air Pollution Study of the National Capital Region. EPS 5-AP-72-4.

Environmental Protection Service, Air Pollution Control Directorate. (1973) Canadian Automobile Driver Survey. EPS 3-AP-73-10.

Environmental Protection Service, Air Pollution Control Directorate. (1974) Canadian Taxi Survey. EPS 3-AP-74-4.

Environmental Protection Service, Air Pollution Control Directorate. (1974). Canadian Urban Trucking Study. EPS 3-AP-74-7.

Environmental Protection Service, Air Pollution Control Directorate. (1979). Canadian Vehicle Survey. EPS 3-AP-79-1.

Environmental Protection Service, Air Pollution Control Directorate. Clean Air Act Annual Report 1973-1974. G5-CA.

Environmental Protection Service, Air Pollution Control Directorate. Clean Air Act Annual Report 1974-1975. G6-CA.

Environmental Protection Service, Air Pollution Control Directorate. Clean Air Act Annual Report 1975-1976. G7-CA.

Environmental Protection Service, Air Pollution Control Directorate. Clean Air Act Annual Report 1976-1977. G8-CA.

Environmental Protection Service, Air Pollution Control Directorate. Clean Air Act Annual Report 1977-1978. G9-CA.

Environmental Protection Service, Air Pollution Control Directorate. Clean Air Act Annual Report 1978-1979. G10-CA.

Environmental Protection Service, Air Pollution Control Directorate. Clean Air Act Annual Report 1979-1980. G11-CA.

Environmental Protection Service, Air Pollution Control Directorate. Clean Air Act Annual Report 1980-1981. G12-CA.

Environmental Protection Service, Air Pollution Control Directorate. Clean Air Act Annual Report 1981-1982. G13-CA.

Environmental Protection Service, Air Pollution Control Directorate. Control of Excessive Emissions of Fuel Consumption by In-Use Motor Vehicles. EPS 3-AP-81-3.

Environmental Protection Service, Air Pollution Control Directorate. (1973). Exploratory Lead Studies in High Traffic Density Areas in Vancouver, Toronto and Montreal. EPS5-AP-73-2.

Environmental Protection Service, Air Pollution Control Directorate. (1973). National Air Pollution Surveillance: Annual Summary for 1972. EPS 5-AP-73-15.

Environmental Protection Service, Air Pollution Control Directorate. (1974). National Air Pollution Surveillance: Annual Summary for 1973. EPS 5-AP-74-13.

Environmental Protection Service, Air Pollution Control Directorate. (1976). National Air Pollution Surveillance: Annual Summary for 1974. EPS 5-AP-76-15.

Environmental Protection Service, Air Pollution Control Directorate. (1976) National Air Pollution Surveillance: Annual Summary for 1975. EPS 5-AP-76-16.

Environmental Protection Service, Air Pollution Control Directorate. (1977). National Air Pollution Surveillance: Annual Summary for 1976. EPS 5-AP-77-13.

Environmental Protection Service, Air Pollution Control Directorate. (1978). National Air Pollution Surveillance: Annual Summary for 1977. EPS 5-AP-78-13.

Environmental Protection Service, Air Pollution Control Directorate. (1978). National Air Pollution Surveillance: Annual Summary for 1978. EPS 5-AP-78-26.

Environmental Protection Service, Air Pollution Control Directorate. (1980). National Air Pollution Surveillance: Annual Summary for 1979. EPS 5-AP-80-15.

Environmental Protection Service, Air Pollution Control Directorate. (1981). National Air Pollution Surveillance: Annual Summary for 1980. EPS 5-AP-81-13.

Environmental Protection Service, Air Pollution Control Directorate. (1982). National Air Pollution Surveillance: Annual Summary for 1981. EPS 5-AP-82-13. November 1982.

Environmental Protection Service, Air Pollution Control Directorate. (1981). Urban Air Quality Trends in Canada 1970-79. EPS 5-AP-81-14.

Environmental Protection Service, Air Pollution Control Directorate, Mobile Sources Division, Abatement and Compliance Branch. (1973). Automobile Emission Trends in Canada 1960-1985. EPS 8-AP-73-1.

Ethyl Corporation. (n.d.) Lead in Gasoline as Related to Car Emissions, the Environment, Economic Impact: Detailed Background for Executive Summary.

Financial Post (1981). Canadian Markets 1982, 57th Edition, Maclean Hunter Ltd., Toronto.

Hanna, S.R., (1973). A simple dispersion model for the analysis of chemically reactive pollutants. Atm. Env. 7, 803.

International Lead Zinc Research Organization, Committee on Energy of Autmotive Emissions. (1981). Comments on "Lead In Gasoline - Canada" Environment Protection Service, Environment Canada, January 11, 1980. (March 16, 1981).

Knettig, P., (1983). Strathcona Industrial Association. Personal communication.

Kolomeychuk, R., Simons, D., Lois, T., Kalanda, B., Phillips, C., and Taylor, G., (1981). National Inventory of Anthropogenic Sources and Emissions of Organic Compounds. Report to Air Pollution Control Directorate, Environmental Protection Service. March, 1981.

Larsen, R.I., Curran, T.C. and Hunt, W.F. Jr. (1980) An air quality data analysis system for interrelating effects, standards and needed source reductions: Part 6. Calculating concentration reductions needed to achieve the new national ozone standard. JAPCA 30, 662-669.

MaCrae, G.J. and Seinfeld, J.H. (1983). "Development of a second-generation mathematical model for urban air pollution - II. Evaluation of model performance." Atmospheric Environment 17, (3):501.

Metropolitan Toronto Planning Department, Transportation Section. (1981). Metro Cordon Count Program - 1981.

National Research Council (U.S.). (1981a). Impacts of Diesel-Powered Light-Duty Vehicles. Health Effects of Exposure to Diesel Exhaust. National Academy Press, Washington.

National Research Council (U.S). (1981b). Impacts of Diesel-Powered Light-Duty Vehicles. Diesel Cars: Benefits, Risks and Public Policy. National Academy Press, Washington.

National Research Council (U.S.). (1981c). Impacts of Diesel-Powered Light-Duty Vehicles. Decision Analysis of Regulating Diesel Cars. National Academy Press, Washington.

National Research Council (U.S.). (1981d). Impacts of Diesel-Powered Light-Duty Vehicles. Diesel Technology. Washington, National Academy Press, Washington.

Ontario Ministry of the Environment. (1979). Air Quality Monitoring Reports. Ontario 1979. Volume 1. ARB-37-81 AQM.

Ontario Ministry of the Environment, Air Resources Branch, Air Quality and Meteorology Section. (1981) Air Quality Trends in Ontario 1971-1979. ARB-017-81-AQM.

Ontario Ministry of the Environment, Air Resources Branch. (1980). Trends of Airborne Particulate Lead in Ontario: 1971-1979.

Ontario Ministry of Transportation and Communications, Licensing and Control Branch. (1978). Vehicle Population by Regional Municipalities.

Petroleum Association for the Conservation of the Canadian Environment (PACE). (1972) A Presentation on Automotive Gaseous and Lead Emissions to the Ministers of Department of Transport and Department of Environment, Government of Canada.

Ricci, P.F. (1972). A comparison of air quality indices for 26 Canadian cities. JAPCA 29, 1242-1243.

Singh, H.B., Ludwig, F.L. and Johnson, W.B. (1978). Tropospheric Ozone: Concentrations and Variabilities in Clean Remote Atmospheres. Atmos. Environ. 12, 2185.

Statistics Canada. (1977). Selected Petroleum Statistics Quarterly. Cat. No. 45-006.

Statistics Canada. (1978a). Selected Petroleum Statistics Quarterly. Cat. No. 45-006. 1978.

Statistics Canada. (1978b). Road Motor Vehicles: Registrations. Cat. No. 53-219.

Statistics Canada. (1980). Road Motor Vehicles: Registrations. Cat. No. 53-219.

Statistics Canada. (1978c). Road Motor Vehicles: Fuel Sales. Cat. No. 53-218.

Statistics Canada. (1978c). Estimates of Population for the Census Metropolitan Areas of Canada. Cat. No. 91-207.

STOP. (1982). The Control of Motor Vehicle Air Pollution: An Unfinished Agenda. Speech delivered at the APCA/FACE Environmental Government Affairs Seminar, Ottawa, Ontario, 15 October.

Technology Service Corporation. (1978). Use of Meteorological Data in Air Quality Trend Analysis. EPA/450/3-78/024. PB-283448.

Tiao, G.C. and Hillman, S.C. (1978). Statistical models for ambient concentrations of carbon monoxide, lead and sulfate based on the LACS data. Env. Sci. Tech. 7, 820-828.

U.S. Environmental Protection Agency. Office of Air Quality Planning and Standards. Guidelines for the Evaluation of Air Quality Trends: Guideline Series Report. OAQPS-1.2-014, PB80-223712. (February 1974.)

APPENDICES

LIST OF APPENDICES

A Air Quality Data Availability and Site Summaries

A1.1 Availability of Air Quality Data for CO, NO_2, O_3, THC and TSP in Toronto

A1.2 Availability of Air Quality Data for CO, NO_2, O_3 and TSP in Montreal

A1.3 Availability of Air Quality Data for CO, NO_2, O_3, THC and TSP in Vancouver

A1.4 Availability of Air Quality Data for CO, NO_2, O_3, THC and TSP in Edmonton

A2.1 Site Summaries for Toronto Monitoring Stations

A2.2 Site Summaries for Montreal Monitoring Stations

A2.3 Site Summaries for Vancouver Monitoring Stations

A2.4 Site Summaries for Edmonton Monitoring Stations

B Tabulations of Data for Toronto

B1.1 Summary of Monthly and Annual Mean Concentrations for CO

B1.2 Percentile Distribution of CO Concentrations

B1.3 Summary of Exceedances of National Air Quality Objectives for CO

LIST OF APPENDICES (Cont'd)

B2.1 Summary of Monthly and Annual Mean Concentrations for NO_2

B2.2 Percentile Distribuion of NO_2 Concentrations

B2.3 Summary of Exceedances of National Air Quality Objectives for NO_2

B3.1 Summary of Monthly and Annual Mean Concentrations for O_3

B3.2 Percentile Distribution of O_3 Concentrations

B3.3 Summary of Exceedances of National Air Quality Objectives for O_3

B4.1 Summary of Monthly and Annual Mean Concentrations for THC

B4.2 Percentile Distribution of THC Concentrations

B4.3 Number of Stations, Data Recovery and Maximum Daily and Hourly Mean THC Concentrations

B5.1 Summary of Monthly and Annual Mean Concentrations for TSP

B5.2 Percentile Distribution of TSP Concentrations

B5.3 Summary of Exceedances of National Air Quality Objectives for TSP

LIST OF APPENDICES (Cont'd)

C Tabulations of Data for Montreal

C1.1 Summary of Monthly and Annual Mean Concentrations for CO

C1.2 Percentile Distribution of CO Concentrations

C1.3 Summary of Exceedances of National Air Quality Objectives for CO

C2.1 Summary of Monthly and Annual Mean Concentrations for NO_2

C2.2 Percentile Distribution of NO_2 Concentrations

C2.3 Summary of Exceedances of National Air Quality Objectives for NO_2

C3.1 Summary of Monthly and Annual Mean Concentrations for O_3

C3.2 Percentile Distribution of O_3 Concentrations

C3.3 Summary of Exceedances of National Air Quality Objectives for O_3

C4.1 Summary of Monthly and Annual Mean Concentrations for TSP

C4.2 Percentile Distribution of TSP Concentrations

C4.3 Summary of Exceedances of National Air Quality Objectives for TSP

LIST OF APPENDICES (Cont'd)

D Tabulations of Data for Vancouver

D1.1 Summary of Monthly and Annual Mean Concentrations for CO

D1.2 Percentile Distribution of CO Concentrations

D1.3 Summary of Exceedances of National Air Quality Objectives for CO

D2.1 Summary of Monthly and Annual Mean Concentrations for NO_2

D2.2 Percentile Distribution of NO_2 Concentrations

D2.3 Summary of Exceedances of National Air Quality Objectives for NO_2

D3.1 Summary of Monthly and Annual Mean Concentrations for O_3

D3.2 Percentile Distribution of O_3 Concentrations

D3.3 Summary of Exceedances of National Air Quality Objectives for O_3

D4.1 Summary of Monthly and Annual Mean Concentrations for TSP

D4.2 Percentile Distribution of TSP Concentrations

D4.3 Summary of Exceedances of National Air Quality Objectives for TSP

LIST OF APPENDICES (Cont'd)

E Tabulations of Data for Edmonton

E1.1 Summary of Monthly and Annual Mean Concentrations for CO

E1.2 Percentile Distribution of CO Concentrations

E1.3 Summary of Exceedances of National Air Quality Objectives for CO

E2.1 Summary of Monthly and Annual Mean Concentrations for NO_2

E2.2 Percentile Distribution of NO_2 Concentrations

E2.3 Summary of Exceedances of National Air Quality Objectives for NO_2

E3.1 Summary of Monthly and Annual Mean Concentrations for O_3

E3.2 Percentile Distribution of O_3 Concentrations

E3.3 Summary of Exceedances of National Air Quality Objectives for O_3

LIST OF APPENDICES (Cont'd)

E4.1 Summary of Monthly and Annual Mean Concentrations for THC

E4.2 Percentile Distribution of THC Concentrations

E4.3 Number of Stations, Data Recovery and Maximum Daily and Hourly Mean THC Concentrations

E5.1 Summary of Monthly and Annual Mean Concentrations for TSP

E5.2 Percentile Distribution of TSP Concentrations

E5.3 Summary of Exceedances of National Air Quality Objectives for TSP

F Plots of Composite Monthly Means: Toronto

F1.1 Composite Monthly Mean CO Concentrations for All Stations

F1.2 Composite Montly Mean CO Concentrations for Residential Station

F1.3 Composite Monthly Mean CO Concentrations for Nonresidential Stations

F2.1 Composite Monthly Mean NO_2 Concentrations for All Stations

LIST OF APPENDICES (Cont'd)

F2.2 Composite Monthly Mean NO_2 Concentrations for Residential Station

F2.3 Composite Monthly Mean NO_2 Concentrations for Nonresidential Stations

F3.1 Composite Monthly Mean O_3 Concentrations for All Stations

F3.2 Composite Monthly Mean O_3 Concentrations for Residential Station

F3.3 Composite Monthly Mean O_3 Concentrations for Nonresidential Stations

F4.1 Composite Monthly Mean THC Concentrations for All Stations

F4.2 Composite Monthly Mean THC Concentrations for Residential Station

F4.3 Composite Monthly Mean THC Concentrations for Nonresidential Stations

F5.1 Composite Monthly Mean TSP Concentrations for All Stations

F5.2 Composite Monthly Mean TSP Concentrations for Residential Station

F5.3 Composite Monthly Mean TSP Concentrations for Nonresidential Stations

LIST OF APPENDICES (Cont'd)

G Plots of Composite Monthly Means: Montreal

G1.1 Composite Monthly Mean CO Concentrations for All Stations

G1.2 Composite Monthly Mean CO Concentrations for Residential Stations

G1.3 Composite Monthly Mean CO Concentrations for Nonresidential Stations

G2.1 Composite Monthly Mean NO_2 Concentrations for All Stations

G2.2 Composite Monthly Mean NO_2 Concentrations for Residential Stations

G2.3 Composite Monthly Mean NO_2 Concentrations for Nonresidential Stations

G3.1 Composite Monthly Mean O_3 Concentrations for All Stations

G3.2 Composite Monthly Mean O_3 Concentrations for Residential Stations

G3.3 Composite Monthly Mean O_3 Concentrations for Nonresidential Stations

LIST OF APPENDICES (Cont'd)

G4.1 Composite Monthly Mean TSP Concentrations for All Stations

G4.2 Composite Monthly Mean TSP Concentrations for Residential Stations

G4.3 Composite Monthly Mean TSP Concentrations for Nonresidential Stations

H Plots of Composite Monthly Means: Vancouver

H1.1 Composite Monthly Mean CO Concentrations for All Stations

H1.2 Composite Monthly Mean CO Concentrations for Residential Stations

H1.3 Composite Monthly Mean CO Concentrations for Nonresidential Stations

H2.1 Composite Monthly Mean NO_2 Concentrations for All Stations

H2.2 Composite Monthly Mean NO_2 Concentrations for Residential Stations

H2.3 Composite Monthly Mean NO_2 Concentrations for Nonresidential Stations

LIST OF APPENDICES (Cont'd)

H3.1 Composite Monthly Mean O_3 Concentrations for All Stations

H3.2 Composite Monthly Mean O_3 Concentrations for Residential Stations

H3.3 Composite Monthly Mean O_3 Concentrations for Nonresidential Stations

H4.1 Composite Monthly Mean TSP Concentrations for All Stations

H4.2 Composite Monthly Mean TSP Concentrations for Residential Stations

H4.3 Composite Monthly Mean TSP Concentrations for Nonresidential Stations

I Plots of Composite Monthly Means: Edmonton

I1.1 Composite Monthly Mean CO Concentrations for All Stations

I1.2 Composite Monthly Mean CO Concentrations for Residential Stations

I1.3 Composite Monthly Mean CO Concentrations for Nonresidential Stations

I2.1 Composite Monthly Mean NO_2 Concentrations for All Stations

LIST OF APPENDICES (Cont'd)

I2.2 Composite Monthly Mean NO_2 Concentrations for Residential Stations

I2.3 Composite Monthly Mean NO_2 Concentrations for Nonresidential Stations

I3.1 Composite Monthly Mean O_3 Concentrations for All Stations

I3.2 Composite Monthly Mean O_3 Concentrations for Residential Stations

I3.3 Composite Monthly Mean O_3 Concentrations for Nonresidential Stations

I4.1 Composite Monthly Mean THC Concentrations for All Stations

I4.2 Composite Monthly Mean THC Concentrations for Residential Stations

I4.3 Composite Monthly Mean THC Concentrations for Nonresidential Stations

I5.1 Composite Monthly Mean TSP Concentrations for All Stations

I5.2 Composite Monthly Mean TSP Concentrations for Residential Stations

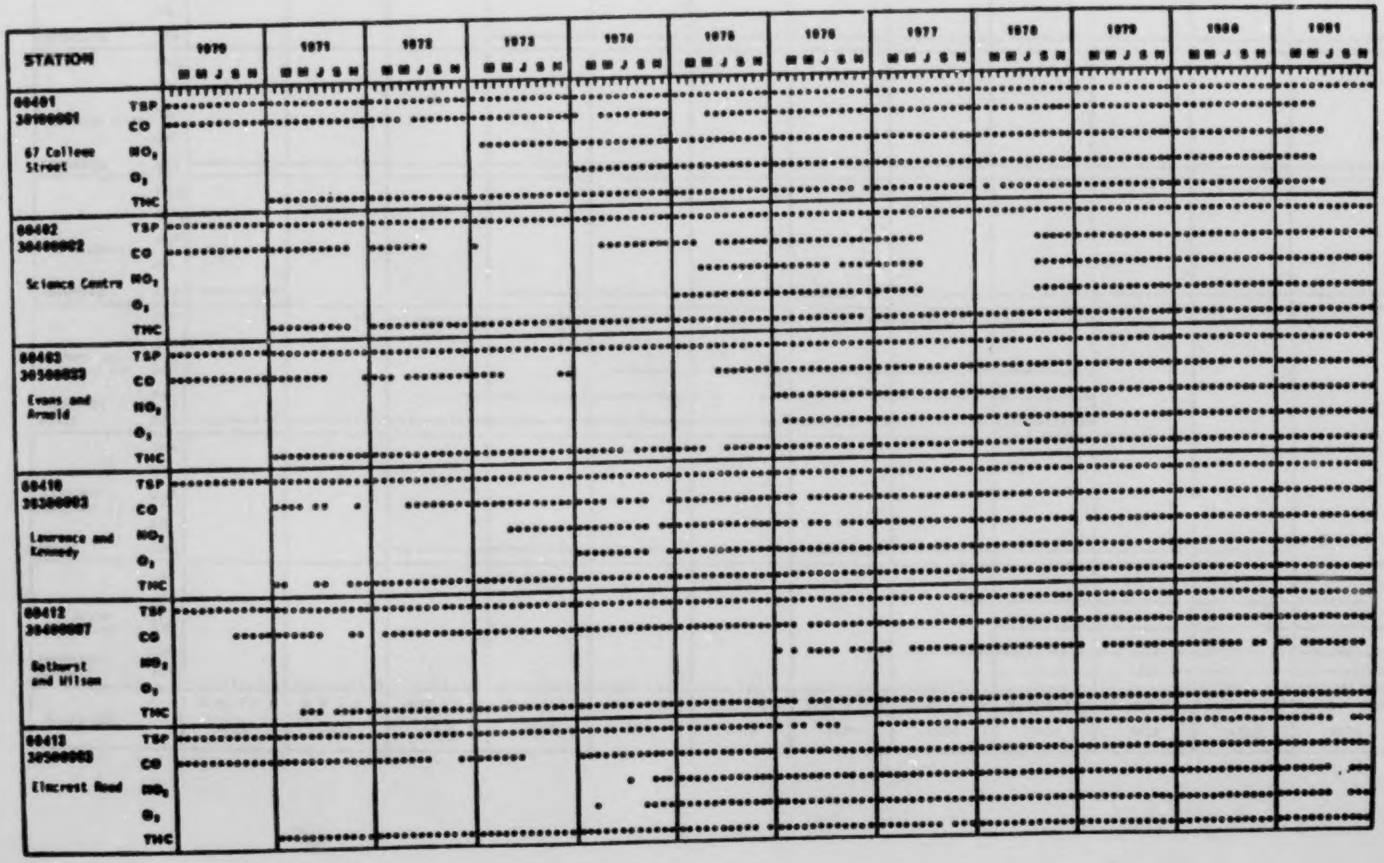
I5.3 Composite Monthly Mean TSP Concentrations for Nonresidential Stations

LIST OF APPENDICES (Cont'd)

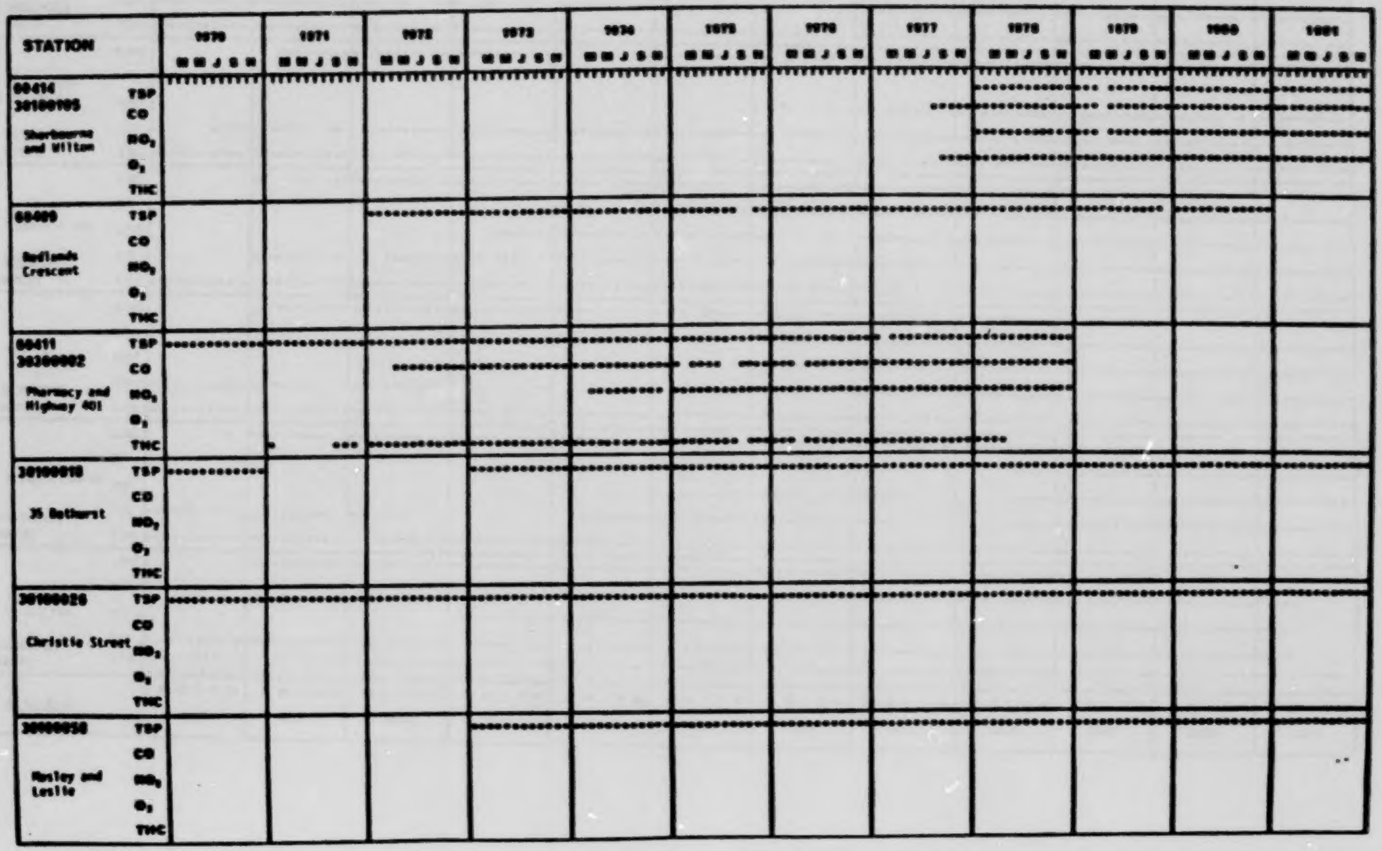
J Mathematical Formulae

APPENDICES

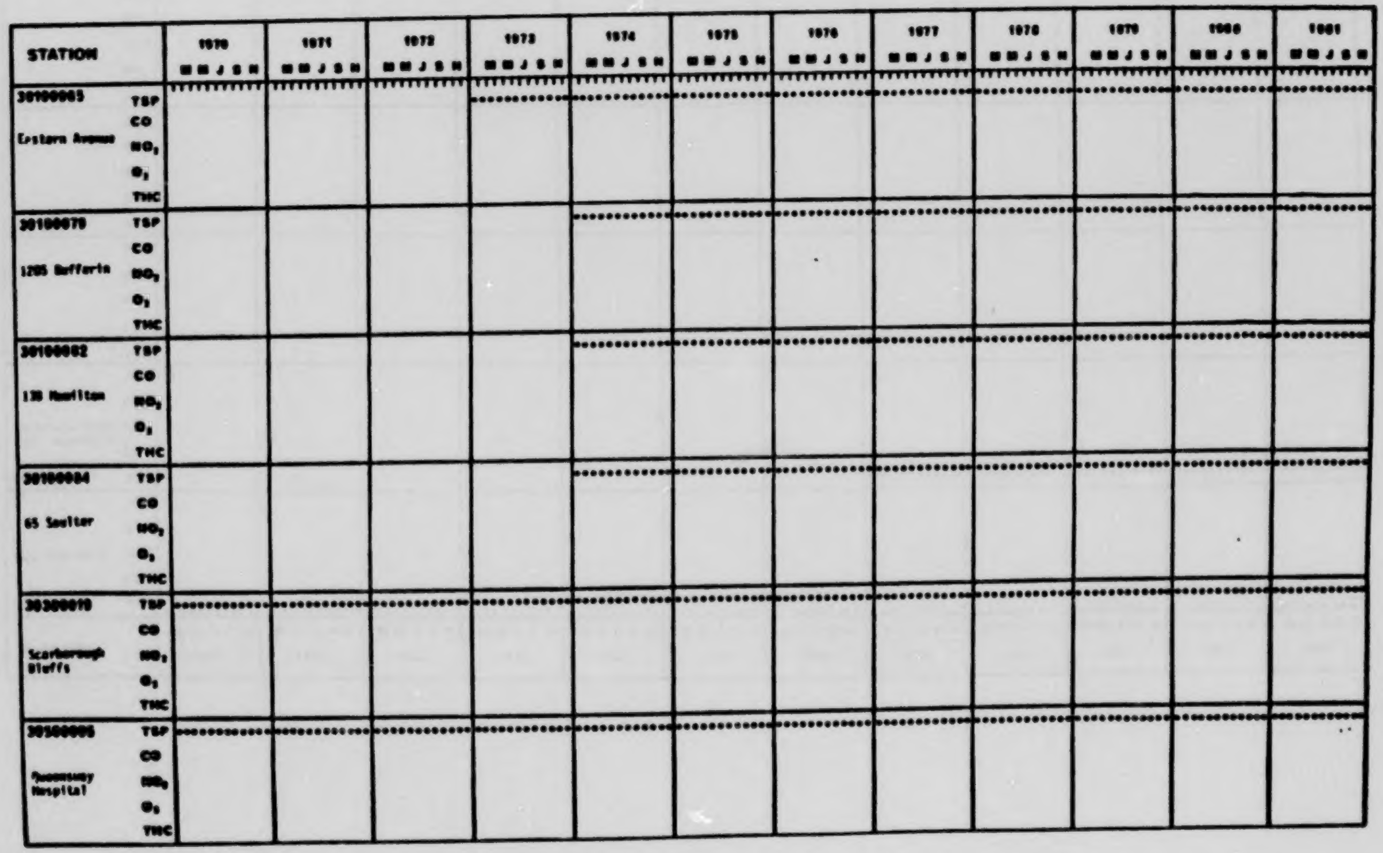
Appendix A1.1 Availability of Air Quality Data for CO, NO_2, O_3, THC and TSP in Toronto.



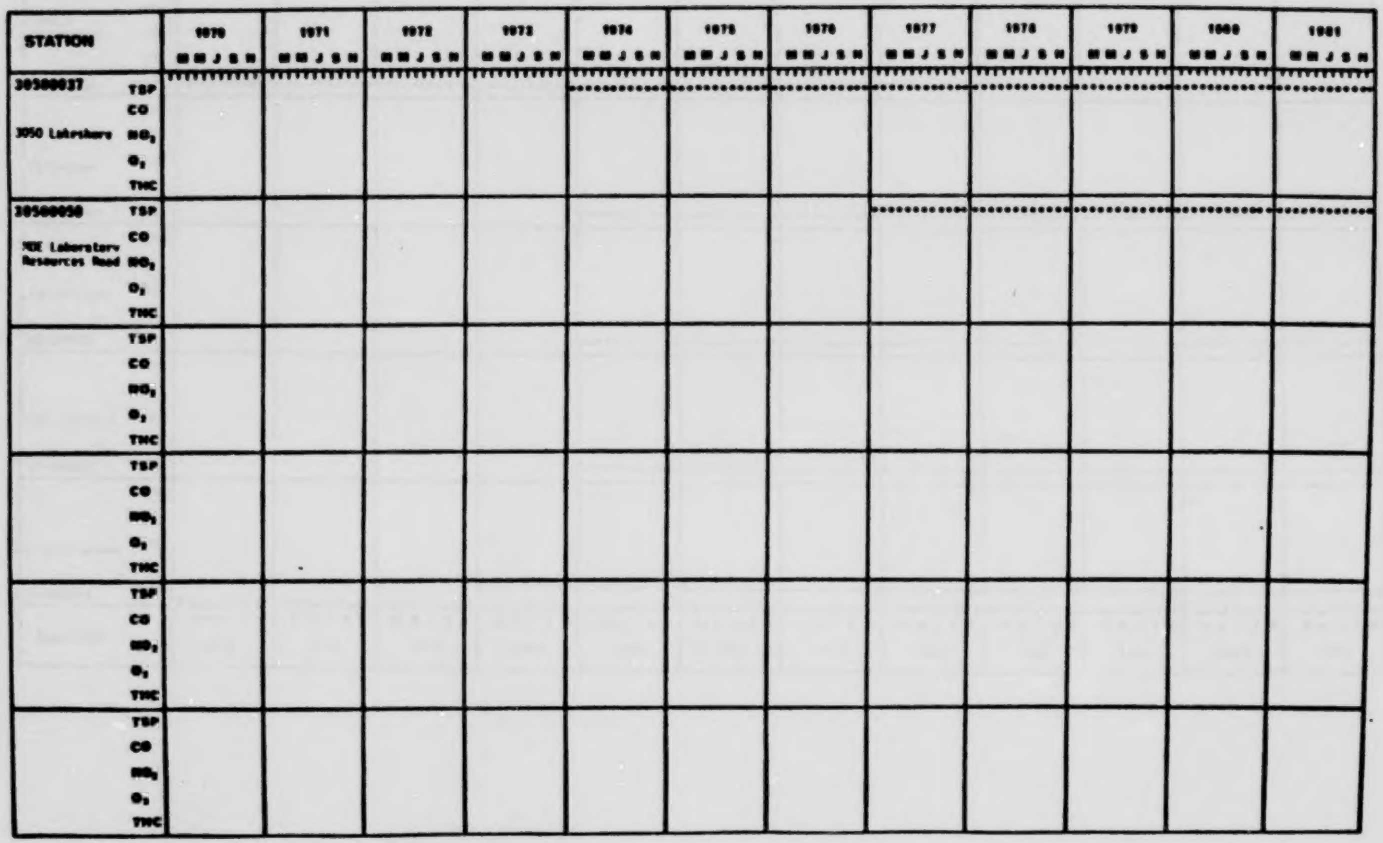
Appendix A1.1 (continued) Availability of Air Quality Data for CO, NO_2, O_3, THC and TSP in Toronto



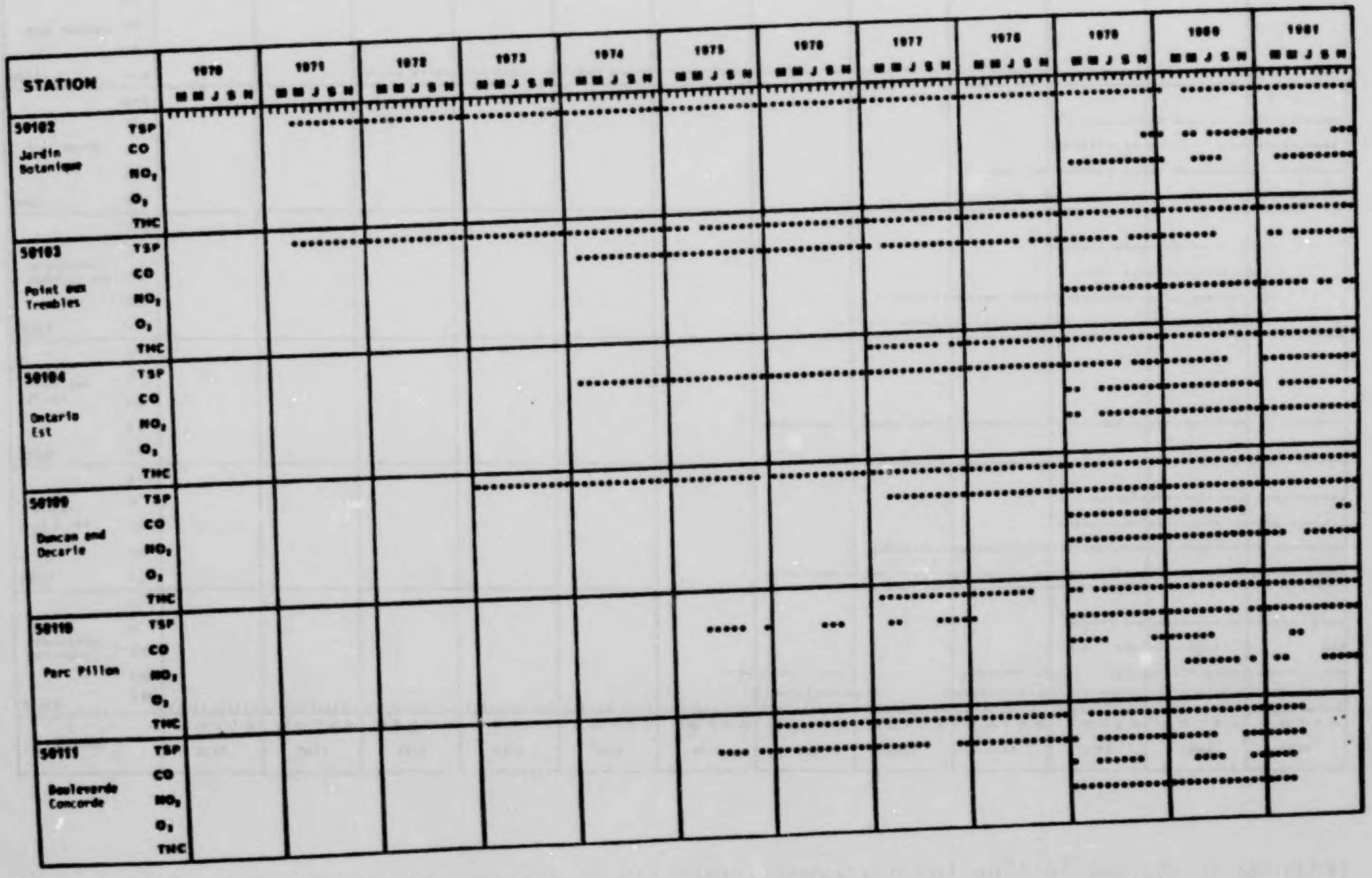
Appendix A1.1 (continued) Availability of Air Quality for CO, NO_2, O_3, THC and TSP in Toronto



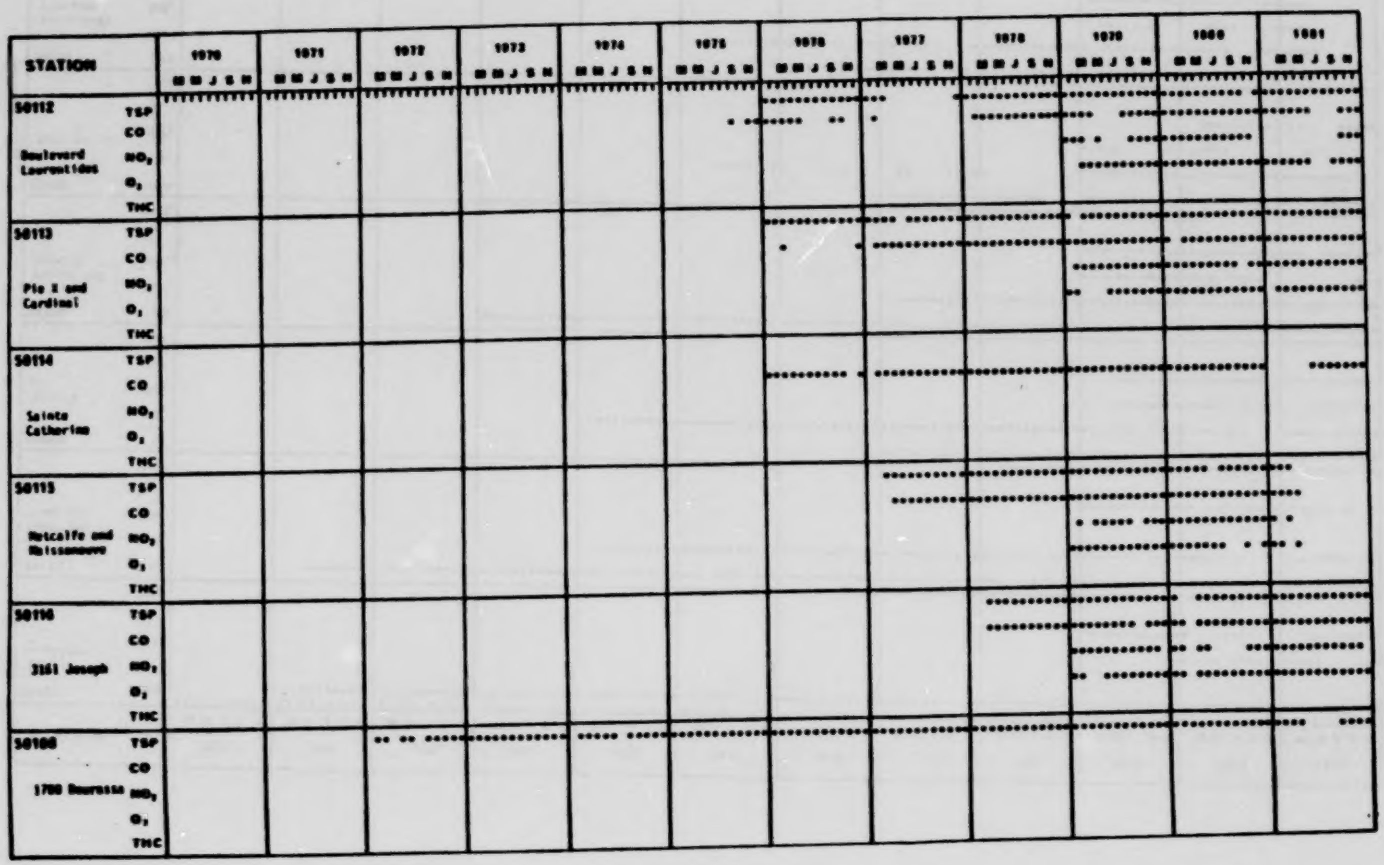
Appendix A1.1 (continued) Availability of Air Quality Data for CO, NO_2, O_3, THC and TSP in Toronto



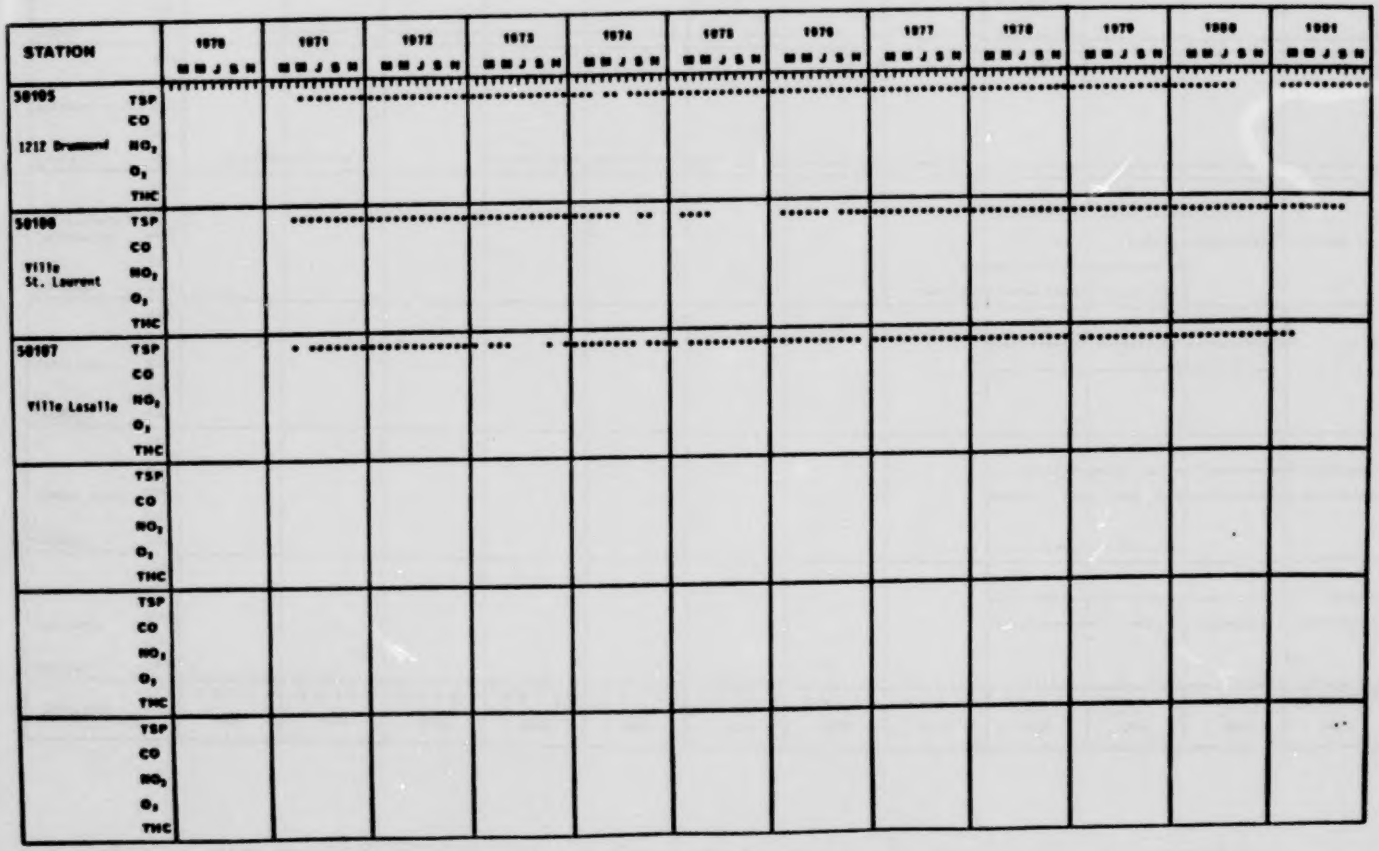
Appendix A1.2 Availability of Air Quality Data for CO, NO_2, O_3, and TSP in Montreal



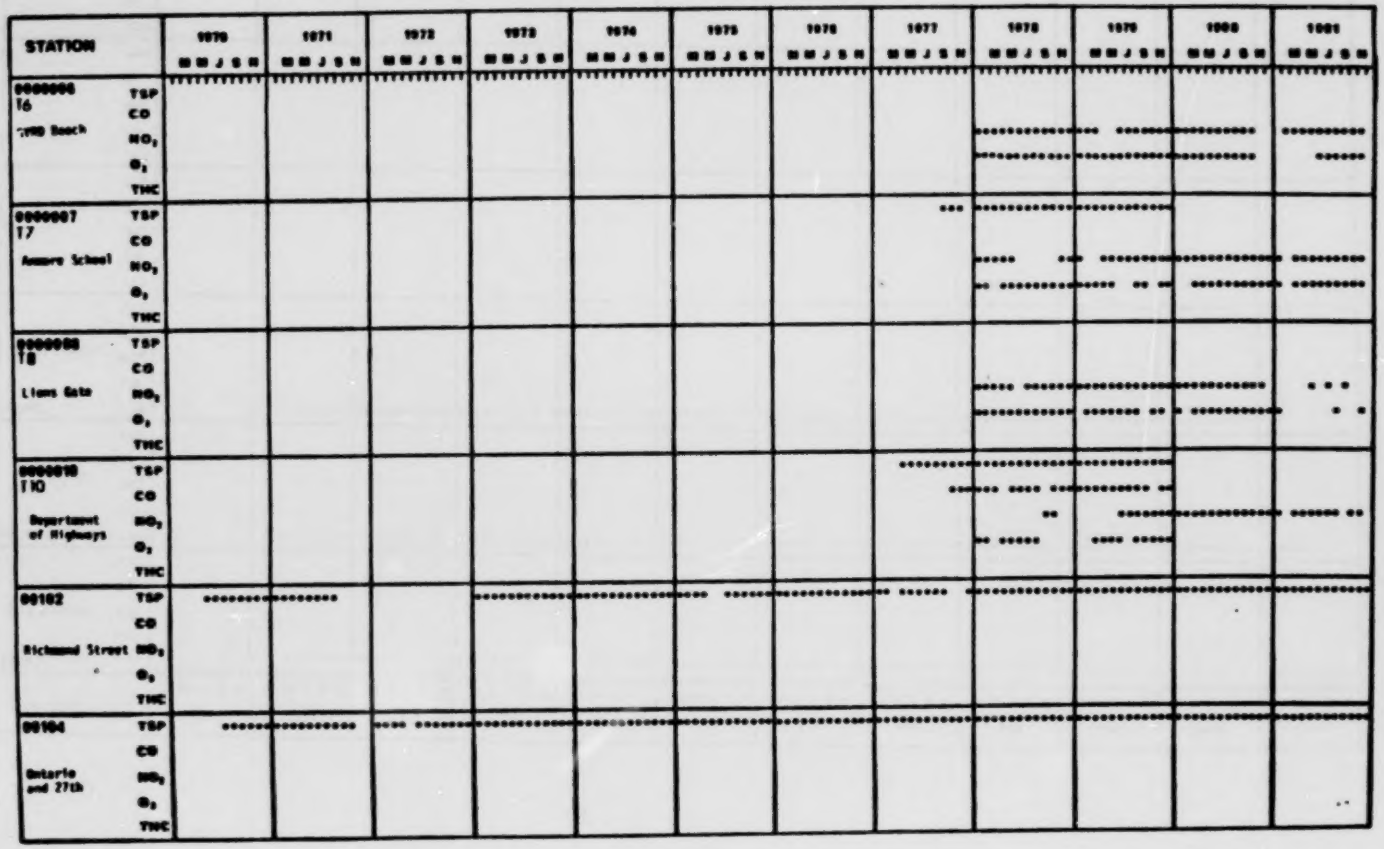
Appendix A1.2 (continued) Availability of Air Quality Data for CO, NO_2, O_3 and TSP in Montreal



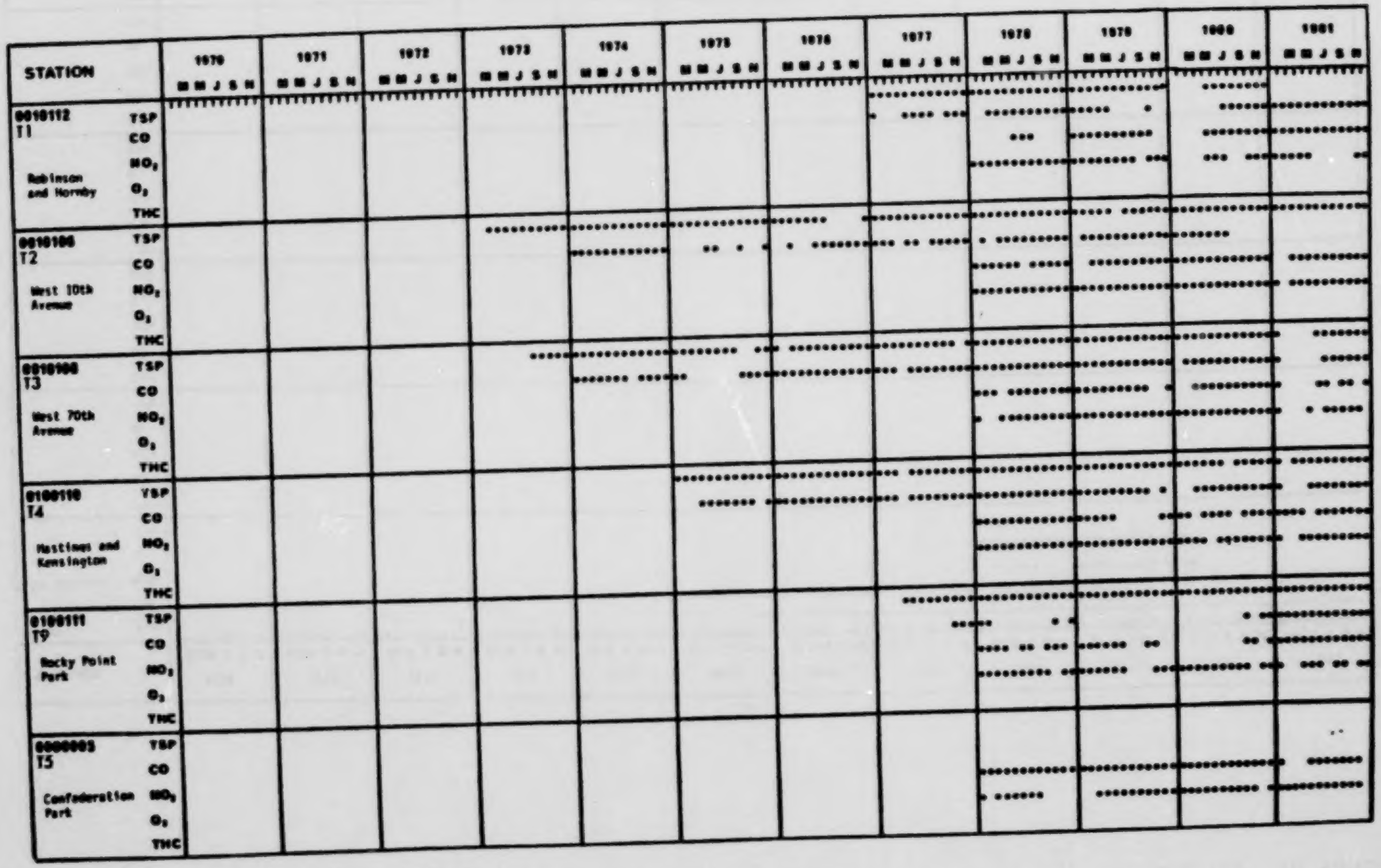
Appendix A1.2 (continued) Availability of Air Quality for CO, NO_2, O_3 and TSP in Montreal



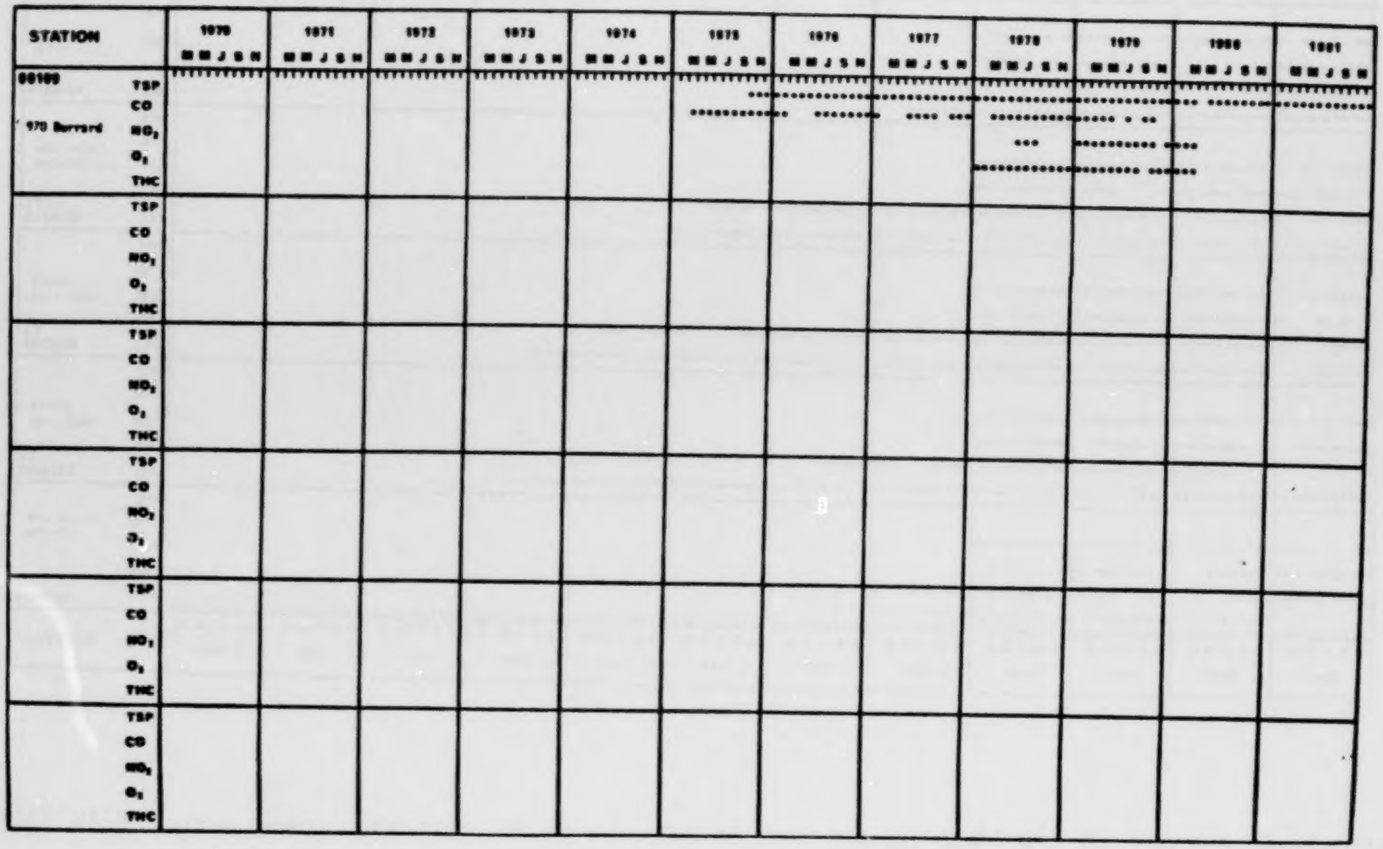
Appendix A1.3 Availability of Air Quality Data for CO, NO_2, O_3, THC and TSP in Vancouver



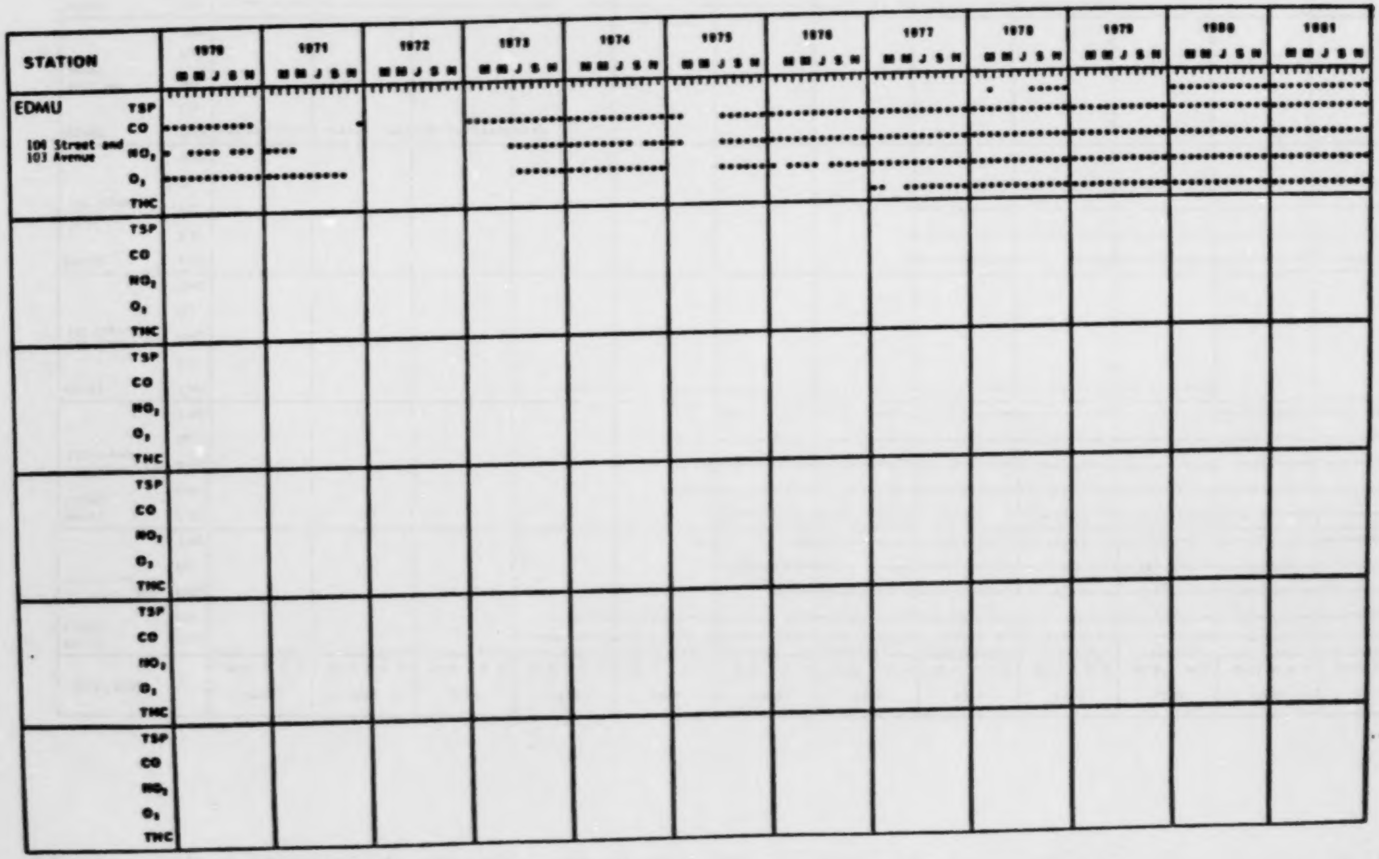
Appendix A1.3 (continued) Availability of Air Quality Data for CO, NO_2, O_3, THC and TSP in Vancouver



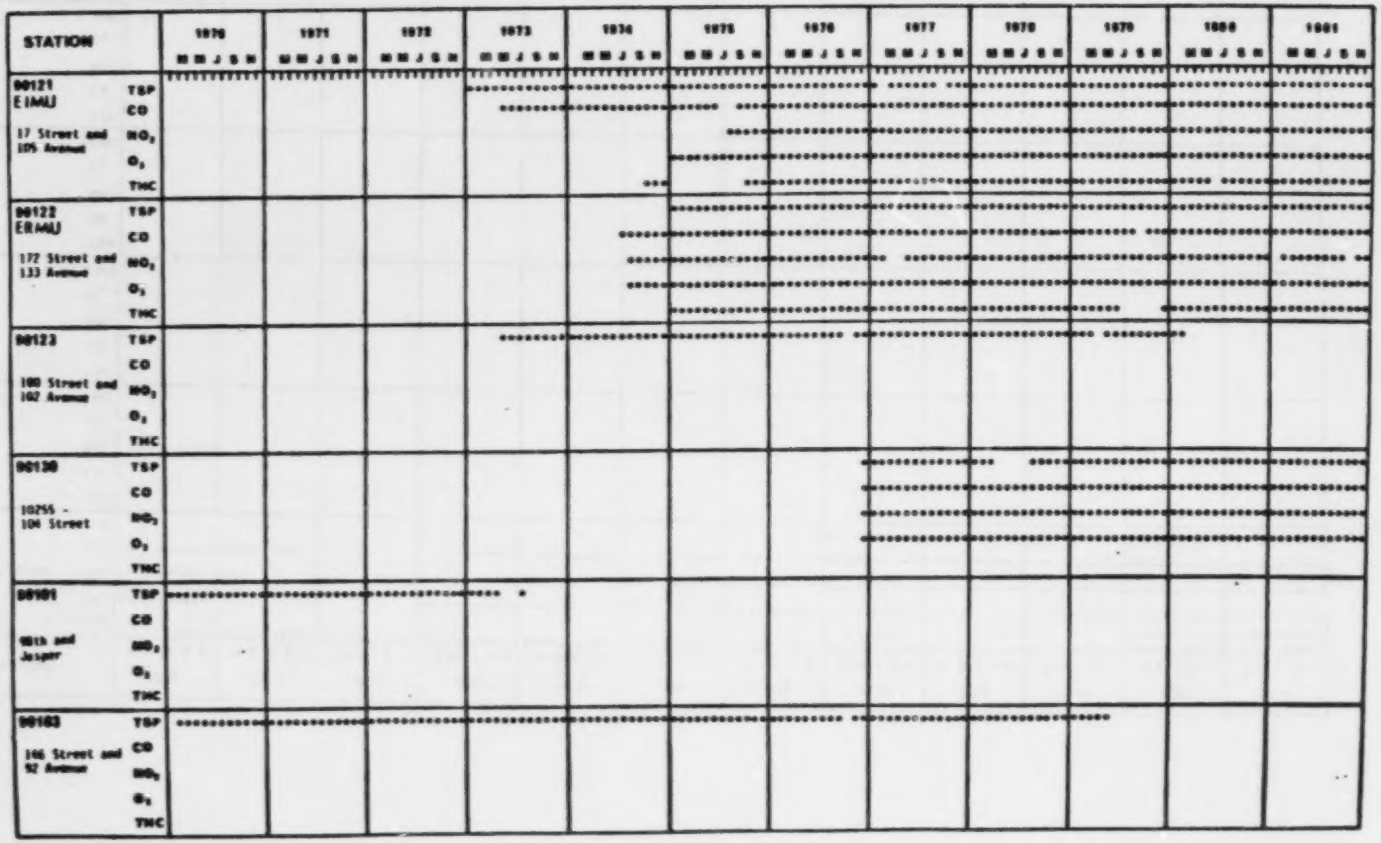
Appendix A1.3 (continued) Availabilty of Air Quality Data for CO, NO_2, O_3, THC and TSP in Vancouver



Appendix A1.4 Availability of Air Quality Data for CO, NO_2, O_3, THC and TSP in Edmonton



Appendix A1.4 (continued) Availability of Air Quality Data for CO_2, NO_2, O_3, THC and TSP in Edmonton



APPENDIX A2.1
SITE SUMMARIES FOR TORONTO MONITORING STATION

Site #	Station Type	Data Source	Location	Comments
60401 30100001	S	MOE	67 College Street	Downtown - vehicular emissions expected to dominate
60402 30400002	R	MOE	Science Centre	Suburban, located in park-like area, representative of residential air quality
60403 30500033	S	MOE	Evans and Arnold	Near (100m) major expressway (QEW) therefore vehicular emissions Local (1 km) particulate sources - dust, fly ash
60410 30300003	S	MOE	Kennedy and Lawrence	At intersection of two major streets, Vehicular emissions dominate
60412 30400007	S	MOE	Bathurst and Wilson	Very heavy vehicular traffic (Highway 401 - 50 m)
60413 30500003	S	MOE	Elmcrest Road	Undeveloped land - road way influences dominate, within 2.5 km of Toronto International Airport
60414 30100105	S	MOE	Sherbourne and Wilton	Industrial sources (lead, particulate within 3 km) Heavy vehicular traffic (expressway) within 250 m
60409	R	MOE	Redland Crescent	Residential area with no significant point sources or roadway influences
604111 30100004	S	MOE	Pharmacy & 401	Residential area next to major expressway
30100018	S	MOE	35 Bathurst	Industrial area with significant traffic sources

A Numbers beginning with 6 are NAPS network numbers.
Others are OME numbers.

APPENDIX A2.1 (cont'd)
SITE SUMMARIES FOR TORONTO MONITORING STATION

Site #	Type	Data Source	Location	Comments
30300019	R	MOE	Scarborough Bluffs	Residential park-like area
30500005	S	MOE	Queensway Hospital	Mixed residential near major traffic source
30100058	S	MOE	Leslie and Mosley	Mixed industrial and traffic sources
30100065	S	MOE	Eastern Avenue	Mixed industrial area
30100079	S	MOE	Dufferin Fire Hall	Mixed area on busy street
30100082	S	MOE	Hamilton Avenue	Mixed industrial area, traffic sources
30100084	S	MOE	65 Saulter Street	Mixed industrial area, traffic sources
30500037	S	MOE	3050 Lakeshore Boulevard	Heavy traffic
30500050	S	MOE	Ministry of the Environment Laboratory	Heavy traffic area

APPENDIX A2.2
SITE SUMMARIES FOR MONTREAL MONITORING STATION

Site #	Type	Data Source	Location	Comments
50102	R	NAPS/CSC*	Jardin Botanique	Suburban, located in park-like area, representative of residential air quality; light vehicular emissions within 50 m
50103	S	NAPS/CSC	Point Aux Tremble	Industrial sources (petrochemical refineries) within 1 km
50104	R	NAPS/CSC	Ontario East	Residential/central commercial area, moderate vehicular emissions
50109	S	NAPS/CSC	Duncan and Decarie	Light industrial/commercial area, at intersection of two major highways, therefore heavy vehicular emissions
50110	R	NAPS/CSC	Parc Pillon	Residential/commercial area, moderate vehicular emissions
50111	R	NAPS/CSC	Boulevard Concorde	Suburban residential area with moderate vehicular emissions
50112	R	NAPS/CSC	Boulevard Laurentides	Residential area - moderate vehicular emmissions
50113	R	NAPS/CSC	Pie X and Cardinal	Light residential area - no significant immediate vehicular sources
50114	S	NAPS	St Catharine	Commercial area downtown Montreal - roadway influences dominant
50115	S	NAPS/CSC	Metcalfe and Maissoneuve	Typical commercial/residential area near downtown. Heavy vehicular traffic
50116	S	NAPS/CSC	3161 Joseph	Moderate residential and light industrial area. Heavy traffic within 250 m.

CSC* Refers to data contained in Concord Scientific Corporation data archive which was created for "Montreal and Quebec Oxidant Study (CSC, 1983). Original data were obtained from NAPS, Quebec Environment and CUM.

APPENDIX A2.2 (cont'd)
SITE SUMMARIES FOR MONTREAL MONITORING STATION

Site #	Type	Data Source	Location	Comments
50105	S	NAPS	1212 Drummond	Residential and commercial area with heavy vehicular emissions
50106	R	NAPS	Ville St. Laurent	Residential area - no significant immediate vehicular sources
50107	S	NAPS	Ville Lasalle	Residential/industrial area. Gas manufacturer and industrial park to the west of site (within 1 km). Site located between two heavily travelled roads. Railway yards within close proximity to site (<1 km)
50108	S	NAPS	1700 Bourassa	

CSC* Refers to data contained in Concord Scientific Corporation data archive which was created for "Montreal and Quebec Oxidant Study (CSC, 1983). Original data were obtained from NAPS, Quebec Environment and CUM.

APPENDIX A2.3
SITE SUMMARIES FOR VANCOUVER MONITORING STATION

Site #	Type	Data Source	Location	Comments
0010112 (T1)	S	NAPS/CSC*	Robinson - Hornby	Central Urban Site - vehicular emissions dominant
00106 (T2)	R	NAPS/CSC	West 10th Avenue	Residential area, light industrial (brewery, warehousing), light vehicular emissions
00108 (T3)	S	NAPS/CSC	West 70th Avenue	Mixed industrial area (liquid oxygen bottling plant, Hydro substation, iron works)
00110 (T4)	S	NAPS/CSC	Hastings/Kensington Park	Park/residential area within a few hundred meters of Hastings Highway. Sources within 1 km (oil refinery)
00111 (T9)	R	NAPS/CSC	Rocky Point Park	Mixed residential/commercial area in park.
0000005 (T5)	R	NAPS/CSC	Confederation Park	Park with residential area, no significant vehicular emissions
0000006 (T6)	S	NAPS/CSC	75 Riverside Drive	Mixed industrial area (shipyards, warehousing, paint and sandblasting shop, cement mixing, Hooker Chemical Plant)
0000007 (T7)	R	NAPS/CSC	Anmore School	Residential area, no significant vehicular emissions
0000008 (T8)	R	NAPS/CSC	Lion's Gate	Residential area, open flats under Lion's Gate Bridge
0000010 (T10)	S	NAPS/CSC	Dept. Highways	Commercial Area, 1 block from Lougheed Highway, therefore, significant vehicular emissions
00102	R*	NAPS/CSC	Richmond Street	Residential area with no significant vehicular emissions. Possible influences are a hospital and Mills.

CSC* Refers to data contained in Concord Scientific Corporation data archive which was created for "Vancouver Oxidants Study" (CSC, 1982). Original data were obtained from NAPS, B.C. Environment and the Greater Vancouver Regional District (GVRD).

APPENDIX A2.3 (cont'd)
SITE SUMMARIES FOR VANCOUVER MONITORING STATION

Site #	Type	Data Source*	Location	Comments
00104	R*	NAPS/CSC	Ontario and 27th	Residential area with no significant vehicular emissions or industrial sources
00109	S	NAPS/CSC	970 Burrard	Commercial area with significant vehicular emissions. Roadway influences. Railway terminal and docks within 2 km.

APPENDIX A2.4
SITE SUMMARIES FOR EDMONTON MONITORING STATION

Site #	Type	Data Source	Location	Comments
90121 (EIMU)	S	NAPS	17th Street and 105 Avenue	Industrial sources (oil refineries, steel and chemical plants within 2.5 km - moderate vehicular emissions
90122 (ERMU)	R	NAPS	127th Street and 133 Avenue	Suburban residential area with moderate vehicular emissions
90123	S	NAPS	100 Street and 102 Avenue	Commercial area - roadway influences dominate (Downtown Edmonton)
90130	S	NAPS	10255 Street and 104 Street	Central commercial area with heavy vehicular emissions (Downtown Edmonton) sources (bus depot, railway yard, power stacks) within 1.5 km
90101	S	NAPS	98th Street and Jasper	Commercial area (Downtown Edmonton). Roadway influences dominate
90103	R	NAPS	146 Street and 92 Avenue	Residential area, no point sources or roadway influences
EDMU	S	Alberta Environment	104th Street and 103 Avenue	Edmonton Downtown Monitoring Unit

* Hydrocarbon data were obtained from Alberta Environment

B1.1

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR CO
TORONTO : ALL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1970	3.7	4.1	3.0	3.1	3.4	3.1	2.9	4.3	5.0	4.8	3.6	4.0	3.7	60.1
1971	3.8	3.7	4.3	4.0	4.4	5.8	4.7	2.4	3.2	3.1	2.7	2.2	3.9	52.7
1972	2.0	2.1	2.0	2.1	3.1	4.2	3.5	2.3	3.8	4.2	4.9	3.3	3.3	46.0
1973	3.2	3.8	3.2	3.2	3.6	3.4	3.6	4.6	4.7	5.2	3.6	3.0	3.7	67.6
1974	4.1	4.1	3.8	3.5	3.0	2.6	2.8	2.8	3.4	2.5	2.5	2.7	3.1	61.7
1975	2.2	2.0	1.9	2.0	2.5	2.0	2.0	1.6	1.8	1.9	2.2	2.3	2.0	75.6
1976	2.0	1.7	1.7	1.3	1.6	1.5	1.2	1.4	1.6	1.6	1.7	1.8	1.6	91.7
1977	1.6	1.4	1.6	1.7	1.8	1.8	1.7	1.8	2.0	2.4	2.2	2.2	1.9	76.0
1978	2.0	2.0	1.8	1.7	1.9	1.8	1.6	2.0	1.8	1.9	2.4	1.9	1.9	89.8
1979	1.5	2.0	2.0	1.7	1.7	1.6	1.6	1.6	1.9	1.7	2.0	1.8	1.8	82.9
1980	1.5	1.4	1.4	1.5	1.6	1.5	1.4	1.3	1.6	1.5	1.6	1.7	1.5	96.6
1981	1.5	1.4	1.4	1.1	1.3	1.3	1.5	1.7	1.6	1.8	2.2	1.8	1.5	85.5

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF CO
TORONTO : RESIDENTIAL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1970	2.5	2.7	3.7	3.4	3.2	3.8	3.7	4.7	5.2	3.5	3.2	2.2	3.5	89.4
1971	3.5	2.1	3.1	2.4	2.2	4.0	4.3	3.6	5.2	.	.	.	3.4	67.0
1972	1.9	4.2	3.5	3.5	3.4	3.5	3.4	.	.	.	.	.	3.4	35.0
1974	.	.	2.0	2.6	3.3	3.7	2.5	2.7	3.5	3.1	3.2	2.8	3.0	60.7
1975	1.8	1.3	1.7	.	.	1.3	1.9	1.3	1.7	1.8	2.2	2.7	1.8	73.3
1976	2.1	2.0	2.0	1.5	1.1	1.1	1.0	1.3	1.5	1.5	1.4	1.5	1.5	98.7
1978	.	.	.	.	.	.	.	1.8	1.8	1.7	2.3	2.0	1.9	41.0
1979	2.3	2.6	2.0	2.0	1.8	1.3	1.9	1.6	1.6	0.8	1.2	0.7	1.6	97.4
1980	1.3	1.0	1.0	1.1	1.4	1.7	1.9	1.6	1.9	1.5	1.4	1.1	1.4	94.5
1981	1.1	1.3	1.2	1.0	1.0	0.8	2.1	3.1	2.2	1.9	2.9	2.1	1.7	92.5

B1.1 cont'd.

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF CO
TORONTO : NONRESIDENTIAL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1970	4.0	4.4	2.7	3.0	3.4	2.8	2.6	4.1	4.9	5.1	3.7	4.6	3.8	54.2
1971	3.9	4.1	4.6	4.5	4.9	6.5	4.9	1.9	2.0	3.1	2.7	2.2	4.1	49.8
1972	2.0	1.7	1.6	1.4	2.9	4.5	3.6	2.3	3.8	4.2	4.9	3.3	3.3	47.8
1973	3.2	3.8	3.2	3.2	3.6	3.4	3.6	4.6	4.7	5.2	3.6	3.0	3.7	67.6
1974	4.1	4.1	3.9	3.8	2.8	2.3	2.9	2.8	3.4	2.3	2.3	2.7	3.1	61.9
1975	2.3	2.2	1.9	2.0	2.5	2.1	2.0	1.7	1.8	1.9	2.2	2.3	2.1	76.0
1976	2.0	1.6	1.6	1.3	1.7	1.6	1.2	1.5	1.6	1.7	1.7	1.8	1.6	90.5
1977	1.6	1.4	1.6	1.7	1.8	1.8	1.7	1.8	2.0	2.4	2.2	2.2	1.9	86.8
1978	2.0	2.0	1.8	1.7	1.9	1.8	1.6	2.0	1.8	1.9	2.4	1.8	1.9	96.8
1979	1.4	1.9	2.0	1.7	1.6	1.7	1.6	1.6	1.9	1.9	2.1	2.0	1.8	80.8
1980	1.5	1.5	1.5	1.5	1.6	1.4	1.3	1.2	1.5	1.5	1.7	1.8	1.5	97.0
1981	1.5	1.4	1.4	1.2	1.4	1.4	1.4	1.5	1.4	1.8	2.1	1.7	1.5	84.3

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF CO CONCENTRATIONS (PPM)

TORONTO : ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1970	1277	1.3	2.0	3.1	5.0	7.2	11.7	3.8	15.4
1971	1119	1.2	2.0	3.2	5.3	7.8	12.2	3.9	16.2
1972	1132	0.9	1.6	2.7	4.2	7.7	10.0	3.3	10.8
1973	1436	1.0	1.8	2.8	4.8	8.5	11.3	3.7	16.6
1974	1313	1.3	1.8	2.6	3.7	6.0	9.0	3.1	10.1
1975	1639	0.9	1.2	1.8	2.6	3.5	5.3	2.0	11.2
1976	2353	0.7	1.0	1.5	2.0	2.6	3.9	1.6	5.9
1977	2226	1.0	1.3	1.8	2.3	2.9	4.5	1.9	6.6
1978	2627	1.0	1.3	1.8	2.3	2.9	4.3	1.9	6.5
1979	2463	0.8	1.1	1.6	2.2	3.0	4.7	1.8	6.9
1980	2495	0.7	1.0	1.4	1.9	2.4	3.5	1.5	5.6
1981	2226	0.6	1.0	1.4	2.0	2.6	4.1	1.5	7.4

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF CO CONCENTRATIONS (PPM)

TORONTO : RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1970	319	1.4	2.3	3.4	4.8	6.0	8.5	3.6	8.7
1971	243	1.1	2.1	3.0	4.4	5.8	6.9	3.3	8.8
1972	124	1.9	2.6	3.4	4.3	4.8	7.7	3.5	7.8
1974	210	1.6	2.1	2.8	4.0	4.8	7.0	3.1	7.1
1975	260	1.0	1.2	1.7	2.1	3.1	4.7	1.8	6.7
1976	364	0.8	1.1	1.4	2.0	2.3	3.2	1.5	3.5
1978	151	1.2	1.6	1.9	2.3	2.6	4.3	1.9	4.4
1979	365	0.5	1.1	1.6	2.1	2.7	4.1	1.6	4.9
1980	346	0.8	1.0	1.3	1.8	2.3	2.9	1.4	3.2
1981	337	0.7	1.0	1.5	2.3	2.9	5.1	1.7	7.2

B1.2 cont'd.

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF CO CONCENTRATIONS (PPM)

TORONTO : NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1970	958	1.2	2.0	3.1	5.2	7.6	12.2	3.8	15.4
1971	876	1.2	1.9	3.2	5.5	8.5	12.2	4.0	16.2
1972	1008	0.8	1.5	2.5	4.2	8.0	10.0	3.3	10.8
1973	1436	1.0	1.8	2.8	4.8	8.5	11.3	3.7	16.6
1974	1103	1.3	1.8	2.5	3.7	6.6	9.0	3.1	10.1
1975	1379	0.9	1.2	1.8	2.7	3.6	5.4	2.1	11.2
1976	1989	0.7	1.0	1.5	2.1	2.7	4.0	1.6	5.9
1977	2226	1.0	1.3	1.8	2.3	2.9	4.5	1.9	6.6
1978	2476	1.0	1.3	1.8	2.3	3.0	4.3	1.9	6.5
1979	2098	0.8	1.1	1.6	2.2	3.0	4.7	1.8	6.9
1980	2149	0.7	1.0	1.4	1.9	2.4	3.6	1.5	5.6
1981	1889	0.6	1.0	1.4	1.9	2.5	4.0	1.5	7.4

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR CO
TORONTO : ALL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)	NUMBER GREATER THAN DES 1HR	NUMBER GREATER THAN ACC 1HR
1970	6	60.1	15.4	26	174	0
1971	6	52.7	16.2	25	189	0
1972	7	46.0	14.3	21	54	0
1973	6	67.6	16.6	31	239	0
1974	6	61.7	10.1	22	46	0
1975	6	75.6	13.0	24	31	0
1976	7	91.7	5.9	14	1	0
1977	8	76.0	6.6	16	10	0
1978	8	89.8	6.5	18	7	0
1979	8	82.9	6.9	18	8	0
1980	7	96.6	5.6	13	0	0
1981	7	85.5	7.4	19	2	0

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR CO
TORONTO : RESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)	NUMBER GREATER THAN DES 1HR	NUMBER GREATER THAN ACC 1HR
1970	1	89.4	8.7	19	3	0
1971	1	67.0	8.8	18	2	0
1972	1	35.0	7.8	14	1	0
1974	1	60.7	7.1	15	1	0
1975	1	73.3	6.7	22	3	0
1976	1	98.7	3.5	10	0	0
1978	1	41.0	4.4	9	0	0
1979	1	97.4	4.9	9	0	0
1980	1	94.5	3.2	9	0	0
1981	1	92.5	7.2	12	0	0

SYNCSORT US PATENT # 4210961 COP

B1.3 cont'd.

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR CO
TORONTO : NONRESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)	NUMBER GREATER THAN DES 1HR	NUMBER GREATER THAN ACC 1HR
1970	5	54.2	15.4	26	171	0
1971	5	49.8	16.2	25	187	0
1972	6	47.8	14.3	21	53	0
1973	6	67.6	16.6	31	239	0
1974	5	61.9	10.1	22	45	0
1975	5	76.0	13.0	24	28	0
1976	6	90.5	5.9	14	1	0
1977	7	86.8	6.6	16	10	0
1978	7	96.8	6.5	18	7	0
1979	7	80.8	6.9	18	8	0
1980	6	97.0	5.6	13	0	0
1981	6	84.3	7.4	19	2	0

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR NO2
TORONTO : ALL STATIONS

MEANS(PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1974	25.9	25.5	31.0	30.4	36.8	37.5	47.2	39.1	31.9	36.6	26.1	33.0	33.8	84.3
1975	30.5	30.0	28.3	29.1	37.6	28.1	32.3	36.3	25.1	25.1	20.6	24.8	29.0	89.3
1976	29.4	29.5	29.4	26.7	27.5	34.7	27.0	24.4	32.9	32.1	28.5	30.2	29.5	87.8
1977	29.6	30.9	36.2	38.1	41.8	35.3	34.3	39.5	29.3	33.3	27.3	28.5	33.5	81.1
1978	32.0	38.6	38.1	29.5	40.7	31.9	28.3	34.8	28.6	30.2	31.6	27.4	32.5	89.8
1979	25.4	31.7	35.1	29.4	34.6	32.8	34.0	29.1	29.0	25.3	27.1	23.4	29.6	79.6
1980	20.4	24.3	26.5	29.9	31.4	32.2	31.2	27.5	25.7	24.1	25.0	26.7	27.1	[illegible]
1981	29.0	26.5	24.4	23.6	30.9	27.8	25.6	30.5	22.2	22.0	26.6	23.8	26.2	[illegible]

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF NO2
TORONTO : RESIDENTIAL STATIONS

MEANS(PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1975	.	.	.	22.3	28.4	22.4	26.4	32.6	24.1	26.3	37.5	35.2	28.5	72.8
1976	26.6	29.5	26.8	27.9	25.1	31.0	25.9	.	26.2	26.5	25.0	23.5	26.7	83.4
1977	23.3	22.8	23.1	25.2	21.6	22.6	.	.	.	.	.	.	23.1	48.9
1978	.	.	.	.	.	.	14.7	24.1	20.6	26.8	35.0	26.0	26.1	42.5
1979	22.2	24.0	27.5	21.5	29.4	26.0	27.4	23.4	20.2	19.3	21.1	19.4	23.5	96.8
1980	19.2	19.8	16.9	18.0	14.3	23.8	23.9	19.0	19.2	19.5	22.0	24.4	20.0	97.4
1981	27.6	28.8	19.7	9.6	9.7	9.4	5.7	7.5	7.6	9.2	10.8	16.5	13.5	97.4

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF NO2
TORONTO : NONRESIDENTIAL STATIONS

MEANS(PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1974	25.9	25.5	31.0	30.4	36.8	37.5	47.2	39.1	31.9	36.6	26.1	33.0	33.8	84.3
1975	30.5	30.0	28.3	30.7	40.0	29.5	33.9	37.2	25.4	24.8	16.0	22.1	29.1	93.4
1976	29.8	29.5	29.8	26.5	28.0	35.4	27.1	24.4	33.6	33.0	29.1	31.4	30.0	88.5
1977	30.6	32.3	38.8	40.7	45.4	37.5	34.3	39.5	29.3	33.3	27.3	28.5	34.4	85.7
1978	32.0	38.6	38.1	29.5	40.7	31.9	28.6	36.6	29.8	30.6	31.1	27.6	32.9	96.5
1979	26.0	33.3	36.7	31.0	35.4	33.9	35.1	30.2	30.6	26.3	28.1	24.1	30.8	77.2
1980	20.6	25.1	28.2	31.9	34.3	33.7	32.5	29.1	27.1	24.8	25.5	27.2	28.3	78.4
1981	29.2	26.1	25.4	26.0	34.5	31.2	29.2	36.4	25.7	24.6	29.9	25.7	28.7	69.9

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF NO2 CONCENTRATIONS (PPB)

TORONTO : ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1974	916	17	23	32	41	53	93	33.8	145.7
1975	1633	11	17	26	37	51	84	28.9	140.0
1976	2255	13	20	28	37	47	70	29.5	100.4
1977	2374	16	23	31	42	55	82	33.5	115.2
1978	2633	17	24	31	39	49	76	32.5	108.8
1979	2358	14	20	28	37	48	72	29.6	110.0
1980	2387	12	18	25	34	44	66	27.1	87.5
1981	2183	10	17	25	34	44	66	26.2	91.7

PERCENTILE DISTRIBUTION OF NO2 CONCENTRATIONS (PPB)

TORONTO : RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1975	270	14	19	26	37	44	67	28.5	72.2
1976	306	15	20	26	32	38	52	26.8	67.5
1977	180	13	17	22	29	35	48	23.1	50.0
1978	156	15	19	25	31	39	72	26.0	89.2
1979	361	11	16	23	30	36	59	23.5	64.2
1980	362	10	14	19	25	31	44	20.1	47.4
1981	358	4	7	11	19	28	47	13.6	55.8

PERCENTILE DISTRIBUTION OF NO2 CONCENTRATIONS (PPB)

TORONTO : NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1974	916	17	23	32	41	53	93	33.8	145.7
1975	1363	10	17	26	38	52	86	29.0	140.0
1976	1949	13	20	29	38	48	71	29.9	100.4
1977	2194	17	23	32	43	56	82	34.4	115.2
1978	2477	18	24	31	39	50	77	32.9	108.8
1979	1997	15	21	29	38	49	74	30.8	110.0
1980	2025	13	20	27	35	45	68	28.3	87.5
1981	1825	13	20	28	36	45	67	28.7	91.7

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR NO2
TORONTO : ALL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DAILY MEAN	MAX HOURLY VALUE	NUMBER	GREATER	THAN	---
					ACC 1HR	TOL 1HR	DES 24HR	ACC 24HR
1974	3	84.3	145.7	230	5	0	5	0
1975	5	89.3	140.0	370	7	0	4	0
1976	7	87.8	101.3	180	0	0	0	0
1977	8	81.1	120.0	190	0	0	2	0
1978	8	89.8	108.8	240	1	0	0	0
1979	8	79.6	110.0	190	0	0	0	0
1980	8	80.7	87.5	240	1	0	0	0
1981	8	73.4	91.7	190	0	0	0	0

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR NO2
TORONTO : RESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DAILY MEAN	MAX HOURLY VALUE	NUMBER	GREATER	THAN	---
					ACC 1HR	TOL 1HR	DES 24HR	ACC 24HR
1975	1	72.8	72.2	190	0	0	0	0
1976	1	83.4	67.5	120	0	0	0	0
1977	1	48.9	50.0	100	0	0	0	0
1978	1	42.5	89.2	120	0	0	0	0
1979	1	96.8	64.2	110	0	0	0	0
1980	1	97.4	47.4	140	0	0	0	0
1981	1	87.4	55.8	90	0	0	0	0

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR NO2
TORONTO : NONRESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DAILY MEAN	MAX HOURLY VALUE	NUMBER	GREATER	THAN	---
					ACC 1HR	TOL 1HR	DES 24HR	ACC 24HR
1974	3	84.3	145.7	230	5	0	5	0
1975	4	93.4	140.0	370	7	0	4	0
1976	6	88.5	101.3	180	0	0	0	0
1977	7	85.7	120.0	190	0	0	2	0
1978	7	96.5	108.8	240	1	0	0	0
1979	7	77.2	110.0	190	0	0	0	0
1980	7	78.4	87.5	240	1	0	0	0
1981	7	69.9	91.7	190	0	0	0	0

B3.1

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR OZONE
TORONTO : ALL STATIONS

MEANS(PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1974	8.3	16.2	21.8	20.6	21.5	26.5	26.8	29.6	16.1	12.9	7.5	6.9	18.5	85.5
1975	7.5	14.4	27.3	33.8	35.0	32.1	32.3	24.1	14.1	11.9	8.1	7.3	20.6	94.4
1976	7.0	10.7	14.8	18.1	19.8	28.1	18.1	21.1	16.8	7.7	6.7	5.9	14.7	92.4
1977	7.1	11.5	14.9	16.0	22.1	19.9	25.6	18.4	10.5	7.0	5.9	6.2	13.6	78.8
1978	8.0	10.1	17.4	17.1	24.6	21.9	28.6	24.8	15.6	9.3	6.2	6.1	15.6	88.3
1979	7.7	10.7	13.6	15.2	15.5	22.7	23.6	14.9	13.7	7.1	4.3	5.5	12.9	91.7
1980	6.7	9.7	13.8	14.3	19.8	20.2	22.7	20.4	11.7	7.8	6.2	5.2	13.2	95.1
1981	5.6	7.5	12.5	16.5	18.1	20.1	25.0	21.5	9.4	7.4	7.1	6.0	12.9	83.9

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF OZONE
TORONTO : RESIDENTIAL STATIONS

MEANS(PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1975	5.3	15.2	25.9	30.4	28.2	26.4	28.8	21.1	12.4	11.3	6.7	6.9	18.2	93.5
1976	6.7	7.8	13.7	17.4	17.3	24.3	15.6	15.8	13.3	7.2	6.4	4.2	12.4	97.3
1977	4.0	6.9	10.2	11.1	15.8	13.4	.	.	.	.	.	.	10.2	49.0
1978	.	.	.	.	.	.	.	28.4	17.7	10.2	7.5	7.9	14.4	41.0
1979	10.0	13.9	13.8	14.7	14.2	18.1	18.7	14.2	17.1	9.5	5.8	7.2	13.1	96.8
1980	8.4	12.1	16.8	16.8	23.9	23.3	27.4	25.3	14.5	10.6	9.3	6.6	16.3	95.0
1981	7.4	10.0	16.7	20.4	21.5	23.3	27.6	24.2	11.4	9.2	8.0	7.1	15.6	92.9

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF OZONE
TORONTO : NONRESIDENTIAL STATIONS

MEANS(PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1974	8.3	16.2	21.8	20.6	21.5	26.5	26.8	29.6	16.1	12.9	7.5	6.9	18.5	85.5
1975	8.3	14.2	27.8	35.0	37.3	34.0	33.5	25.1	14.6	12.1	8.5	7.4	21.3	94.7
1976	7.0	11.5	15.0	18.3	20.5	29.0	18.7	22.6	17.8	7.9	6.8	6.4	15.3	91.2
1977	7.9	12.7	16.0	17.2	23.7	21.5	25.6	18.4	10.5	7.0	5.9	6.2	14.0	84.8
1978	8.0	10.1	17.4	17.1	24.6	21.9	28.6	24.1	15.1	9.1	5.9	5.7	15.7	97.8
1979	7.2	10.0	13.5	15.4	15.7	23.7	24.6	15.0	13.0	6.5	4.0	5.1	12.9	90.7
1980	6.4	9.3	13.2	13.8	19.0	19.6	21.6	19.3	11.1	7.1	5.6	4.9	12.6	95.1
1981	5.2	7.0	11.7	16.0	17.4	19.3	24.3	20.6	8.8	7.0	6.8	5.7	12.3	82.1

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF OZONE CONCENTRATIONS (PPB)

TORONTO : ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1974	618	5	10	17	25	35	57	18.6	64.8
1975	1382	4	9	17	30	43	67	20.6	88.0
1976	1701	4	7	12	20	30	49	14.7	80.2
1977	1736	3	6	12	19	26	43	13.6	57.7
1978	1944	4	7	13	21	32	58	15.6	89.3
1979	2021	3	6	11	17	25	49	12.9	67.2
1980	2110	3	6	11	18	26	42	13.2	55.7
1981	1861	3	6	11	18	25	44	12.9	59.5

PERCENTILE DISTRIBUTION OF OZONE CONCENTRATIONS (PPB)

TORONTO : RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1975	342	3	8	16	27	36	53	18.2	57.8
1976	360	3	6	11	18	23	40	12.4	46.3
1977	179	3	6	10	14	17	23	10.2	27.5
1978	151	4	7	11	17	33	60	14.5	63.6
1979	361	5	8	13	17	22	35	13.1	43.2
1980	353	5	9	15	23	30	49	16.4	50.2
1981	335	4	8	14	21	28	47	15.6	50.8

PERCENTILE DISTRIBUTION OF OZONE CONCENTRATIONS (PPB)

TORONTO : NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1974	618	5	10	17	25	35	57	18.6	64.8
1975	1040	4	9	17	31	46	72	21.4	88.0
1976	1341	4	7	13	20	31	53	15.3	80.2
1977	1557	3	6	12	20	27	44	14.0	57.7
1978	1793	4	7	13	21	32	60	15.7	89.3
1979	1660	3	6	10	17	25	50	12.9	67.2
1980	1757	3	6	11	17	25	41	12.5	55.7
1981	1526	3	5	10	17	25	43	12.3	59.5

SEIA TREND ANALYSIS

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR OZONE
TORONTO : ALL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	--- DES 1HR	NUMBER ACC 1HR	GREATER TOL 1HR	THAN DES 24HR	--- ACC 24HR
1974	2	85.5	68.8	157	868	174	1	360	160
1975	4	94.4	88.0	201	3203	780	11	761	458
1976	5	92.4	80.2	142	1781	291	0	676	253
1977	6	78.8	57.7	126	1108	84	0	651	204
1978	6	88.3	90.2	140	2274	469	0	814	340
1979	6	91.7	67.2	165	1231	177	2	661	202
1980	6	95.1	63.5	129	1199	156	0	740	246
1981	6	83.9	60.4	113	1177	131	0	627	210

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR OZONE
TORONTO : RESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	--- DES 1HR	NUMBER ACC 1HR	GREATER TOL 1HR	THAN DES 24HR	--- ACC 24HR
1975	1	93.5	57.8	136	564	123	0	184	104
1976	1	97.3	46.3	139	249	34	0	119	30
1977	1	49.0	27.5	65	17	0	0	37	1
1978	1	41.0	63.6	140	199	70	0	49	23
1979	1	96.8	43.2	99	122	6	0	122	21
1980	1	95.0	50.2	125	338	51	0	177	63
1981	1	92.9	50.8	99	357	49	0	162	51

SYNCS

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR OZONE
TORONTO : NONRESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	--- DES 1HR	NUMBER ACC 1HR	GREATER TOL 1HR	THAN DES 24HR	--- ACC 24HR
1974	2	85.5	68.8	157	868	174	1	360	160
1975	3	94.7	88.0	201	2639	657	11	577	354
1976	4	91.2	80.2	142	1532	257	0	557	223
1977	5	84.8	57.7	126	1091	84	0	614	203
1978	5	97.8	90.2	135	2075	399	0	765	317
1979	5	90.7	67.2	165	1109	171	2	539	181
1980	5	95.1	63.5	129	861	105	0	563	183
1981	5	82.1	60.4	113	820	82	0	465	159

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF THC
TORONTO : RESIDENTIAL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1971	1.83	1.95	2.15	1.98	1.94	2.20	2.17	2.51	2.54	2.44	.	.	2.17	66.4
1972	1.59	1.71	1.33	1.55	1.93	1.66	2.31	2.45	2.09	2.24	2.15	2.03	1.98	75.4
1973	2.20	2.26	2.48	2.53	2.87	4.29	3.23	3.63	3.39	2.87	1.79	1.64	2.78	92.1
1974	1.75	1.72	1.58	2.05	1.83	2.12	2.14	2.61	2.14	2.44	2.00	2.11	2.02	90.6
1975	1.79	1.88	1.72	1.81	2.33	1.91	1.65	1.66	1.58	1.96	1.96	1.91	1.86	88.0
1976	1.59	1.71	1.85	2.03	1.89	2.26	2.22	2.33	1.38	1.38	1.55	.	1.84	89.3
1977	2.46	2.45	2.68	2.54	2.73	2.42	2.25	.	.	.	.	.	2.53	43.1
1978	.	.	.	.	.	.	1.43	2.04	2.06	2.07	2.19	1.89	2.03	41.8
1979	1.67	1.62	1.91	1.64	1.67	1.58	1.61	1.51	1.59	1.55	1.85	1.80	1.67	96.0
1980	1.49	1.42	1.47	1.45	1.61	1.68	1.31	1.26	1.38	1.38	1.52	1.76	1.48	95.1
1981	1.87	1.81	1.74	1.42	1.55	1.49	1.52	1.64	1.42	1.57	2.22	1.92	1.68	96.0

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR THC
TORONTO : ALL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1971	1.82	1.87	1.99	1.78	2.06	2.31	1.96	2.34	2.12	2.10	1.74	1.58	1.96	55.4
1972	1.65	1.74	1.62	1.67	2.09	1.80	1.95	1.91	1.88	1.98	2.11	2.10	1.88	78.2
1973	2.04	1.96	1.95	1.79	1.84	2.09	1.96	2.02	2.31	2.23	1.91	1.83	1.99	89.1
1974	1.99	1.88	1.60	1.87	2.00	1.98	2.14	2.21	2.00	2.30	2.30	2.20	2.04	85.9
1975	1.95	2.02	1.80	1.79	2.21	1.95	1.90	1.89	1.91	2.02	2.04	2.04	1.96	89.1
1976	1.90	1.90	1.98	2.18	2.21	2.48	2.04	1.96	1.68	1.61	1.57	1.81	1.94	90.6
1977	1.91	1.75	1.85	1.82	1.92	1.92	1.80	1.61	1.53	1.86	1.77	1.98	1.82	87.0
1978	1.96	1.90	2.16	1.95	2.04	1.92	1.82	2.06	1.97	1.98	2.13	1.93	1.98	76.5
1979	1.75	1.82	2.01	1.71	1.81	2.00	1.74	1.59	1.76	1.78	1.96	1.81	1.81	93.9
1980	1.70	1.72	1.85	1.65	1.71	1.77	1.63	1.63	1.64	1.55	1.93	1.97	1.73	95.2
1981	1.98	1.89	1.80	1.68	1.84	1.82	1.73	1.84	1.72	2.00	2.28	2.11	1.89	71.4

B4.1 cont'd.

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF THC
TORONTO : NONRESIDENTIAL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1971	1.81	1.85	1.93	1.71	2.10	2.35	1.89	2.26	2.00	2.07	1.74	1.58	1.92	53.6
1972	1.65	1.75	1.65	1.70	2.11	1.83	1.88	1.78	1.84	1.94	2.11	2.12	1.87	78.7
1973	2.01	1.92	1.88	1.70	1.65	1.66	1.70	1.72	2.12	2.12	1.93	1.87	1.86	88.6
1974	2.03	1.92	1.61	1.84	2.03	1.95	2.15	2.16	1.98	2.27	2.35	2.21	2.04	85.1
1975	1.97	2.04	1.82	1.79	2.19	1.95	1.93	1.92	1.97	2.03	2.06	2.06	1.97	89.3
1976	1.95	1.93	2.00	2.22	2.27	2.52	2.01	1.90	1.73	1.64	1.57	1.81	1.96	90.9
1977	1.82	1.63	1.71	1.80	1.80	1.84	1.78	1.61	1.53	1.86	1.77	1.98	1.76	94.3
1978	1.96	1.90	2.16	1.95	2.04	1.92	1.83	2.07	1.96	1.96	2.11	1.94	1.98	82.3
1979	1.77	1.86	2.03	1.72	1.83	2.08	1.77	1.61	1.80	1.83	1.98	1.81	1.84	93.5
1980	1.74	1.78	1.93	1.69	1.73	1.79	1.69	1.71	1.70	1.59	2.01	2.02	1.78	95.3
1981	2.00	1.91	1.82	1.72	1.91	1.91	1.79	1.90	1.82	2.10	2.29	2.17	1.94	67.3

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF THC CONCENTRATIONS (PPM)

TORONTO : ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1971	1369	1.26	1.50	1.87	2.32	2.77	4.00	1.96	5.60
1972	1932	1.23	1.50	1.84	2.25	2.61	3.24	1.89	3.96
1973	2237	1.31	1.56	1.87	2.24	2.79	5.21	2.00	7.33
1974	2140	1.44	1.65	1.90	2.26	2.76	4.27	2.03	5.87
1975	2255	1.38	1.62	1.92	2.22	2.59	3.43	1.96	4.64
1976	2303	1.29	1.58	1.85	2.18	2.63	4.39	1.94	5.98
1977	2206	1.12	1.45	1.81	2.13	2.45	3.38	1.82	4.53
1978	1948	1.41	1.64	1.94	2.30	2.61	3.39	1.99	4.00
1979	2072	1.20	1.44	1.75	2.12	2.46	3.40	1.81	8.27
1980	2098	1.25	1.40	1.67	2.00	2.31	2.99	1.73	4.34
1981	1844	1.35	1.62	1.87	2.10	2.40	3.43	1.89	4.91

PERCENTILE DISTRIBUTION OF THC CONCENTRATIONS (PPM)

TORONTO : RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1971	239	1.36	1.60	1.92	2.62	3.12	4.81	2.16	5.25
1972	262	1.24	1.53	1.97	2.38	2.74	3.57	1.99	3.85
1973	334	1.58	1.89	2.44	3.36	4.65	6.74	2.78	7.33
1974	323	1.43	1.62	1.87	2.32	2.76	3.65	2.01	4.57
1975	316	1.21	1.47	1.78	2.15	2.65	3.72	1.86	4.09
1976	325	1.26	1.49	1.68	2.12	2.66	3.66	1.84	3.70
1977	156	1.86	2.17	2.42	2.85	3.26	4.01	2.52	4.05
1978	153	1.56	1.70	1.94	2.29	2.55	3.76	2.03	3.93
1979	358	1.25	1.37	1.61	1.87	2.15	3.16	1.66	3.72
1980	351	1.17	1.28	1.40	1.62	1.89	2.67	1.48	2.77
1981	352	1.23	1.40	1.62	1.84	2.14	3.61	1.68	3.88

B4.2 cont'd.

PERCENTILE DISTRIBUTION OF THE CONCENTRATIONS (PPM)

TORONTO : NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1971	1129	1.23	1.48	1.85	2.27	2.69	3.64	1.92	5.60
1972	1670	1.23	1.50	1.83	2.23	2.57	3.21	1.87	3.96
1973	1903	1.27	1.52	1.81	2.13	2.52	3.39	1.86	6.66
1974	1817	1.45	1.65	1.90	2.25	2.77	4.34	2.03	5.87
1975	1939	1.41	1.65	1.94	2.24	2.59	3.40	1.97	4.64
1976	1978	1.30	1.61	1.87	2.18	2.63	4.45	1.95	5.98
1977	2050	1.10	1.41	1.78	2.07	2.37	3.15	1.76	4.53
1978	1795	1.39	1.64	1.93	2.31	2.62	3.33	1.98	4.00
1979	1714	1.17	1.46	1.80	2.17	2.51	3.53	1.84	8.27
1980	1747	1.29	1.45	1.74	2.04	2.36	3.09	1.78	4.34
1981	1492	1.43	1.70	1.91	2.14	2.43	3.39	1.94	4.91

SEIA TREND ANALYSIS

NUMBER OF STATIONS, DATA RECOVERY AND MAXIMUM DAILY AND HOURLY MEAN THC CONCENTRATIONS

TORONTO : ALL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)
1971	7	55.4	5.77	12.80
1972	7	78.2	3.96	11.90
1973	7	89.1	7.33	20.20
1974	7	85.9	5.87	11.60
1975	7	89.1	4.64	12.00
1976	7	90.6	5.98	12.60
1977	7	87.0	5.46	12.40
1978	7	76.5	4.00	13.80
1979	6	93.9	8.27	18.00
1980	6	95.2	4.34	10.40
1981	7	71.4	4.91	12.10

NUMBER OF STATIONS, DATA RECOVERY AND MAXIMUM DAILY AND HOURLY MEAN THC CONCENTRATIONS

TORONTO : RESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)
1971	1	66.4	5.25	12.80
1972	1	75.4	3.85	8.20
1973	1	92.1	7.33	20.20
1974	1	90.6	4.57	9.20
1975	1	88.0	4.09	12.00
1976	1	89.3	3.70	8.50
1977	1	43.1	5.46	8.10
1978	1	41.8	3.93	7.90
1979	1	96.0	3.72	6.60
1980	1	95.1	2.77	5.50
1981	1	96.0	3.88	6.60

B4.3 cont'd.

NUMBER OF STATIONS, DATA RECOVERY AND MAXIMUM DAILY AND HOURLY MEAN THC CONCENTRATIONS
TORONTO : NONRESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)
1971	6	53.6	5.77	10.60
1972	6	78.7	3.96	11.90
1973	6	88.5	6.66	13.20
1974	6	85.1	5.87	11.60
1975	6	89.3	4.64	10.90
1976	6	90.9	5.98	12.60
1977	6	94.3	4.53	12.40
1978	6	82.3	4.00	13.80
1979	5	93.5	8.27	18.00
1980	5	95.3	4.34	10.40
1981	6	67.3	4.91	12.10

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR TSP
TORONTO : ALL STATIONS

MEANS(UG/M3)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1970	99.0	117.8	123.5	140.2	138.4	124.5	106.5	97.6	76.5	93.4	85.4	92.7	104.4	28.7
1971	91.3	82.3	115.9	118.6	129.4	136.2	81.6	91.5	99.4	107.9	89.1	74.0	100.0	24.7
1972	74.7	80.0	71.6	96.2	137.1	110.4	100.0	91.7	78.6	68.6	69.1	70.9	85.8	26.5
1973	84.3	92.1	98.2	79.5	83.9	114.9	110.6	121.4	106.0	92.6	78.7	68.6	92.8	23.7
1974	83.9	99.4	92.6	84.8	81.8	88.7	88.7	72.6	70.6	71.2	62.7	65.2	78.0	48.6
1975	67.4	58.9	59.1	64.2	96.4	73.0	85.8	73.5	61.4	70.8	71.1	55.5	69.2	60.1
1976	61.9	73.9	66.5	75.2	66.9	93.6	65.2	72.7	75.7	60.5	74.3	72.9	70.9	66.8
1977	58.3	71.5	82.8	75.4	98.0	76.2	71.9	59.5	53.0	56.7	47.8	50.2	65.4	57.0
1978	46.4	61.4	84.0	68.8	85.9	83.7	78.9	81.5	60.8	58.1	63.0	64.2	68.6	58.5
1979	56.0	71.6	97.9	70.6	89.7	101.8	97.6	81.1	80.4	62.8	72.5	60.5	77.3	59.0
1980	72.9	91.6	70.9	65.7	96.0	83.7	93.1	79.0	65.0	55.7	55.5	70.7	73.6	58.8
1981	58.2	68.0	75.7	72.0	84.7	94.0	78.7	69.8	59.1	43.9	60.0	61.0	67.7	53.3

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF TSP
TORONTO : RESIDENTIAL STATIONS

MEANS(UG/M3)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1970	79.0	87.6	111.9	105.7	66.4	63.1	89.2	73.0	48.8	63.1	67.6	82.2	71.8	15.8
1971	63.9	58.9	78.3	68.3	113.4	102.9	55.9	68.4	69.6	91.4	66.4	54.9	73.9	17.0
1972	62.1	68.5	47.2	74.1	110.1	104.1	92.2	76.1	66.1	52.8	52.3	64.7	70.1	21.3
1973	62.0	60.3	57.3	52.2	61.0	80.7	81.1	82.0	66.2	64.9	40.9	40.8	60.7	22.3
1974	51.0	65.4	60.9	66.5	65.5	60.7	65.8	50.3	44.5	39.2	41.1	42.8	53.3	23.7
1975	50.4	34.6	38.4	38.0	74.2	56.3	63.7	52.9	35.1	56.6	47.1	46.9	48.4	23.2
1976	41.4	48.0	39.5	41.8	41.7	75.0	55.5	58.1	53.5	38.0	41.0	45.6	45.7	30.1
1977	34.0	40.6	60.7	52.6	65.9	48.3	50.4	33.6	30.1	29.2	36.2	31.9	41.3	23.3
1978	25.5	36.4	49.8	36.2	48.5	48.2	55.4	52.5	48.4	33.8	44.9	42.3	42.9	22.5
1979	38.2	46.3	65.6	44.3	63.1	72.1	65.0	56.0	56.6	38.8	50.0	42.6	51.9	23.2
1980	53.8	49.7	49.0	43.7	62.8	62.9	68.2	56.9	36.3	31.8	34.2	58.9	49.6	21.4
1981	48.1	51.9	46.6	50.3	53.7	63.1	50.1	48.3	36.5	28.2	30.3	37.4	43.9	30.8

B5.1 cont'd.

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF TSP
TORONTO : NONRESIDENTIAL STATIONS

MEANS(UG/M3)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1970	100.3	119.5	124.1	141.3	143.9	127.8	110.5	102.5	82.8	101.3	89.5	94.8	109.4	31.9
1971	97.5	89.2	125.5	132.2	133.1	143.2	89.1	96.1	102.9	112.1	91.8	76.4	105.6	27.0
1972	77.6	83.2	78.7	102.0	144.1	111.6	101.5	95.4	81.8	72.3	73.8	72.4	89.7	28.0
1973	90.8	100.1	111.1	87.5	89.2	121.3	116.6	129.8	114.9	99.0	88.6	74.2	100.4	24.0
1974	88.9	103.4	95.2	86.3	82.8	91.0	90.5	74.2	72.2	73.7	64.1	67.1	79.9	52.1
1975	68.3	60.6	60.7	65.8	97.7	74.0	87.0	74.7	62.8	71.6	72.6	56.0	70.4	65.4
1976	63.4	75.5	69.4	79.2	69.8	94.5	65.7	73.5	77.0	61.7	76.6	74.8	72.8	72.0
1977	60.0	73.3	84.1	76.8	99.9	77.5	73.1	61.2	54.3	58.6	48.5	51.3	66.9	61.3
1978	47.5	63.0	86.0	70.7	88.1	85.7	80.4	83.1	61.5	59.5	63.9	65.4	70.0	63.0
1979	57.0	72.9	99.9	72.3	91.2	103.1	99.1	82.7	81.6	64.3	73.8	61.3	78.7	63.4
1980	73.9	93.7	72.0	66.9	97.5	84.7	94.6	80.1	66.4	56.8	56.7	71.2	74.9	63.4
1981	58.9	69.0	77.8	73.9	87.7	96.5	80.6	71.9	61.3	45.6	63.2	63.2	69.8	56.1

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF TSP CONCENTRATIONS (UG/M3)

TORONTO : ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1970	1046	53	74	107	148	201	358	104.9	699.0
1971	813	54	75	100	137	182	284	100.0	417.0
1972	874	45	62	84	121	161	252	85.8	316.0
1973	1038	45	65	96	138	193	351	92.8	483.0
1974	2837	39	55	80	113	150	250	78.0	400.0
1975	3512	35	49	71	99	134	229	69.2	407.0
1976	3910	36	50	72	103	142	241	70.9	474.0
1977	3748	32	46	65	94	133	249	65.4	467.0
1978	3841	32	48	70	102	139	229	68.6	403.0
1979	3874	40	56	79	109	144	234	77.3	420.0
1980	3871	38	52	73	105	141	248	73.6	423.0
1981	3499	35	48	68	96	133	231	67.7	428.0

PERCENTILE DISTRIBUTION OF TSP CONCENTRATIONS (UG/M3)

TORONTO : RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1970	114	42	56	73	106	133	177	74.5	178.0
1971	124	41	54	75	103	130	235	73.9	249.0
1972	156	36	46	68	101	144	244	70.1	316.0
1973	163	29	45	61	87	118	289	60.7	476.0
1974	173	30	39	54	71	105	186	53.3	187.0
1975	169	24	36	51	67	90	134	48.4	135.0
1976	220	25	31	45	63	96	212	45.7	285.0
1977	170	23	30	41	59	78	145	41.3	145.0
1978	164	22	30	43	61	85	142	42.9	157.0
1979	169	28	37	54	73	92	151	51.9	186.0
1980	157	28	36	51	67	91	133	49.6	146.0
1981	225	25	32	45	62	81	113	43.9	148.0

B5.2 cont'd.

PERCENTILE DISTRIBUTION OF TSP CONCENTRATIONS (UG/M3)

TORONTO : NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1970	932	56	78	113	153	206	365	109.4	699.0
1971	689	59	78	105	144	188	294	105.6	417.0
1972	718	49	65	88	127	164	253	89.7	295.0
1973	875	50	70	103	146	199	358	100.4	483.0
1974	2664	40	57	82	115	152	251	79.9	400.0
1975	3343	36	51	72	101	136	234	70.4	407.0
1976	3690	38	51	73	105	145	241	72.8	474.0
1977	3578	34	47	66	96	135	251	66.9	467.0
1978	3677	34	49	72	103	141	230	70.0	403.0
1979	3705	41	57	80	111	146	240	78.7	420.0
1980	3714	39	53	74	106	143	251	74.9	423.0
1981	3274	36	49	70	98	136	234	69.8	428.0

SEIA TREND ANALYSIS

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR TSP
TORONTO : ALL STATIONS

YEAR	NO. OF STNS	% DATA RECOVERY	MAX DLY MEAN (UG/M3)	NO. GREATER THAN ACC 24HR	NO. GREATER THAN TOL 24HR
1970	10	28.7	699.0	435	5
1971	9	24.7	417.0	274	1
1972	9	26.5	316.0	221	0
1973	12	23.7	483.0	349	7
1974	16	48.6	400.0	606	0
1975	16	60.1	407.0	507	1
1976	16	66.8	474.0	656	3
1977	18	57.0	467.0	496	3
1978	18	58.5	403.0	598	1
1979	18	59.0	420.0	724	1
1980	18	58.8	423.0	666	1
1981	18	53.3	428.0	479	2

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR TSP
TORONTO : RESIDENTIAL STATIONS

YEAR	NO. OF STNS	% DATA RECOVERY	MAX DLY MEAN (UG/M3)	NO. GREATER THAN ACC 24HR	NO. GREATER THAN TOL 24HR
1970	2	15.8	178.0	19	0
1971	2	17.0	249.0	17	0
1972	2	21.3	316.0	23	0
1973	2	22.3	476.0	13	1
1974	2	23.7	187.0	12	0
1975	2	23.2	135.0	2	0
1976	2	30.1	285.0	9	0
1977	2	23.3	145.0	2	0
1978	2	22.5	157.0	2	0
1979	2	23.2	186.0	4	0
1980	2	21.4	146.0	2	0
1981	2	30.8	148.0	1	0

B5.3 cont'd.

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR TSP
TORONTO : NONRESIDENTIAL STATIONS

YEAR	NO. OF STNS	% DATA RECOVERY	MAX DLY MEAN (UG/M3)	NO. GREATER THAN ACC 24HR	NO. GREATER THAN TOL 24HR
1970	8	31.9	699.0	416	5
1971	7	27.0	417.0	257	1
1972	7	28.0	295.0	198	0
1973	10	24.0	483.0	336	6
1974	14	52.1	400.0	594	0
1975	14	65.4	407.0	505	1
1976	14	72.0	474.0	647	3
1977	16	61.3	467.0	494	3
1978	16	63.0	403.0	596	1
1979	16	63.4	420.0	720	1
1980	16	63.4	423.0	664	1
1981	16	56.1	428.0	478	2

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR CO
MONTREAL : ALL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1974	.	1.8	1.7	1.5	1.3	1.0	1.2	1.7	1.7	1.8	2.1	2.0	1.6	78.2
1975	2.0	1.7	1.5	1.4	1.6	1.2	1.3	1.4	1.6	1.8	1.6	1.8	1.6	60.0
1976	2.6	2.4	2.1	1.7	1.6	1.9	1.9	1.7	1.5	1.5	1.4	2.8	1.9	70.6
1977	1.3	1.9	1.7	1.6	1.8	2.1	1.8	2.3	2.3	2.5	2.3	2.3	2.0	69.8
1978	1.8	2.3	1.7	1.7	1.7	1.7	1.6	1.6	1.8	1.8	1.9	2.2	1.8	82.4
1979	2.1	2.0	2.0	1.6	1.7	1.6	1.5	1.9	2.1	2.1	2.0	2.2	1.9	85.9
1980	1.8	1.9	1.7	1.4	1.6	1.3	1.4	1.7	1.7	2.0	1.9	2.3	1.7	86.0
1981	2.1	1.6	1.6	1.3	1.3	1.3	1.4	1.8	1.4	1.9	1.7	1.7	1.6	75.2

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF CO
MONTREAL : RESIDENTIAL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1974	.	2.9	2.2	2.5	2.0	1.6	1.8	2.5	2.6	2.5	2.9	2.8	2.4	86.8
1975	2.8	2.6	2.4	2.2	2.1	1.5	1.5	1.7	1.8	2.5	1.8	2.1	1.8	52.0
1976	2.1	1.6	1.5	1.2	1.0	1.2	1.1	1.1	1.3	1.3	1.4	2.1	1.4	63.6
1977	1.6	1.3	1.4	1.1	0.9	1.1	1.0	1.3	1.6	1.9	1.8	1.8	1.4	61.9
1978	1.5	1.7	1.1	0.9	1.2	1.0	0.9	1.1	1.3	1.3	1.7	2.1	1.3	76.1
1979	2.0	1.7	1.7	1.3	1.6	1.3	0.8	1.0	1.4	1.8	1.7	1.5	1.5	80.2
1980	1.4	1.7	1.4	1.1	1.3	1.0	0.9	1.2	1.1	1.5	1.6	2.1	1.4	88.1
1981	1.8	1.6	1.5	1.2	1.2	1.1	1.3	1.7	1.4	1.8	1.5	1.5	1.5	79.3

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF CO
MONTREAL : NONRESIDENTIAL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1974	.	0.8	0.7	0.6	0.3	0.4	0.4	0.8	0.8	1.0	1.0	0.9	0.7	69.6
1975	1.1	0.9	0.6	0.5	0.6	0.5	0.7	0.7	0.8	1.1	0.9	0.7	0.8	91.6
1976	3.3	3.5	3.4	2.5	2.6	3.0	3.3	2.7	2.0	2.1	1.2	3.6	2.8	80.2
1977	0.5	4.4	2.1	2.2	2.5	2.8	2.3	2.8	2.8	2.8	2.8	2.9	2.6	78.7
1978	2.4	2.8	2.3	2.2	2.1	2.3	2.2	2.1	2.2	2.1	2.1	2.4	2.3	88.8
1979	2.1	2.2	2.2	1.9	1.8	1.9	1.8	2.7	2.9	2.4	2.3	2.8	2.3	81.6
1980	2.2	2.0	2.1	1.7	1.8	1.6	1.8	2.2	2.2	2.6	2.3	2.7	2.1	83.8
1981	2.5	1.6	1.7	1.5	1.4	1.5	1.5	1.8	1.3	2.0	1.8	2.0	1.7	71.0

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF CO CONCENTRATIONS (PPM)

MONTREAL : ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	98_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1974	585	0.2	0.7	1.5	2.4	3.1	5.1	1.6	8.3
1975	1085	0.3	0.6	1.3	2.3	3.1	4.8	1.6	6.0
1976	1776	0.1	0.4	1.1	2.8	5.0	7.8	1.8	10.8
1977	2292	0.3	0.7	1.7	3.0	4.3	6.1	2.0	8.3
1978	3001	0.4	0.8	1.4	2.7	3.7	5.8	1.8	9.3
1979	3114	0.4	0.9	1.5	2.7	3.8	6.3	1.9	11.1
1980	3149	0.5	0.9	1.5	2.4	3.3	5.1	1.7	9.5
1981	2720	0.4	0.8	1.3	2.2	3.1	5.0	1.6	7.1

PERCENTILE DISTRIBUTION OF CO CONCENTRATIONS (PPM)

MONTREAL : RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	95_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1974	314	1.3	1.8	2.3	2.9	3.4	5.1	2.4	6.3
1975	758	0.5	1.0	1.9	2.7	3.4	4.9	1.9	6.0
1976	1146	0.1	0.4	1.0	2.1	3.0	4.9	1.3	7.6
1977	1125	0.1	0.5	1.2	2.1	2.8	4.6	1.4	5.6
1978	1378	0.3	0.7	1.1	1.8	2.6	4.3	1.3	7.3
1979	1440	0.3	0.8	1.3	2.0	3.0	4.9	1.5	7.3
1980	1618	0.4	0.8	1.2	1.8	2.5	3.8	1.4	5.1
1981	1446	0.4	0.8	1.3	2.0	2.7	4.8	1.5	6.3

PERCENTILE DISTRIBUTION OF CO CONCENTRATIONS (PPM)

MONTREAL : NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	98_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1974	251	0.0	0.3	0.6	1.0	1.5	3.4	0.7	4.0
1975	327	0.2	0.4	0.7	1.0	1.4	2.8	0.8	3.3
1976	830	0.1	0.4	1.2	5.2	6.5	8.1	2.8	10.8
1977	1167	0.5	1.0	2.6	3.8	4.8	6.4	2.6	8.3
1978	1823	0.6	1.0	2.0	3.3	4.3	8.1	2.2	9.3
1979	1874	0.5	1.0	2.0	3.3	4.4	6.8	2.2	11.1
1980	1530	0.5	1.0	2.0	3.0	3.8	5.6	2.1	9.5
1981	1274	0.4	0.8	1.4	2.5	3.4	5.4	1.7	7.1

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR CO
MONTREAL : ALL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)	NUMBER GREATER THAN DES 1HR	NUMBER GREATER THAN ACC 1HR
1974	2	78.2	6.3	15	3	0
1975	5	80.0	8.0	29	24	0
1976	7	70.6	12.4	30	83	0
1977	9	69.8	8.3	26	54	0
1978	10	82.4	9.3	35	63	1
1979	10	85.9	11.1	26	85	0
1980	10	86.0	8.5	25	44	0
1981	10	75.2	7.1	21	37	0

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR CO
MONTREAL : RESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)	NUMBER GREATER THAN DES 1HR	NUMBER GREATER THAN ACC 1HR
1974	1	86.8	6.3	15	2	0
1975	4	52.0	8.0	29	24	0
1976	5	83.6	9.7	30	16	0
1977	5	61.8	8.0	26	13	0
1978	5	76.1	7.3	35	16	1
1979	5	80.2	8.7	26	19	0
1980	5	88.1	5.1	25	6	0
1981	5	78.3	6.3	21	18	0

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR CO
MONTREAL : NONRESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)	NUMBER GREATER THAN DES 1HR	NUMBER GREATER THAN ACC 1HR
1974	1	69.6	4.0	15	1	0
1975	1	81.6	3.3	12	0	0
1976	2	80.2	12.4	23	67	0
1977	4	79.7	8.3	25	41	0
1978	5	88.8	9.3	30	47	0
1979	5	91.6	11.1	21	66	0
1980	5	83.8	8.5	18	38	0
1981	5	71.0	7.1	18	19	0

C2.1

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR NO2
MONTREAL: ALL STATIONS

MEANS (PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1979	31.8	37.5	35.8	32.8	33.0	29.6	28.4	22.7	28.8	28.7	28.9	30.0	30.6	72.5
1980	31.4	35.2	36.1	31.0	30.9	30.1	23.0	26.8	20.9	24.1	26.9	31.9	29.7	72.9
1981	32.1	28.0	30.5	27.7	29.4	22.4	21.0	22.4	17.9	25.0	24.3	23.3	26.0	49.7
1982	20.8	26.9	27.0	24.4	26.8	22.3	23.0	20.1	20.1	20.2	22.2	.	23.2	62.8

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR NO2
MONTREAL: RESIDENTIAL STATIONS

MEANS (PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1979	29.2	31.4	33.8	31.2	33.3	27.4	24.3	17.9	27.3	26.3	29.8	29.6	28.5	64.9
1980	28.5	30.5	33.9	28.6	28.2	23.8	25.8	25.2	19.1	23.0	24.0	35.2	27.3	72.5
1981	34.4	29.5	30.4	29.3	30.9	25.3	18.7	24.9	20.4	24.7	23.7	25.2	27.1	53.2
1982	28.2	34.4	33.1	29.1	28.8	22.8	22.0	21.0	21.2	19.4	25.3	.	26.3	61.6

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR NO2
MONTREAL: NONRESIDENTIAL STATIONS

MEANS (PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1979	36.6	44.8	39.2	34.8	32.7	32.9	33.9	29.1	30.7	33.0	27.6	30.8	33.7	87.7
1980	36.5	42.3	40.6	35.8	37.4	48.6	36.6	29.4	23.6	25.4	34.3	25.1	34.4	73.9
1981	28.4	24.2	30.6	20.5	22.7	15.4	24.9	17.2	11.9	25.6	25.5	11.1	23.2	42.9
1982	10.1	17.6	19.2	18.6	23.1	21.3	24.3	19.1	19.1	20.8	19.8	.	19.4	64.2

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF NO2 CONCENTRATIONS (PPB)

MONTREAL: ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1979	2359	13	21	30	39	47	66	30.5	86.8
1980	2399	14	20	29	38	47	65	29.7	85.0
1981	1624	14	19	25	32	39	56	26.0	98.0
1982	2047	8	14	22	31	40	59	23.1	160.9

PERCENTILE DISTRIBUTION OF NO2 CONCENTRATIONS (PPB)

MONTREAL: RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1979	1401	12	20	29	36	44	64	28.4	88.8
1980	1587	13	18	27	35	42	58	27.3	77.1
1981	1156	16	20	26	33	40	55	27.1	98.0
1982	1115	13	18	25	33	42	60	26.2	112.2

PERCENTILE DISTRIBUTION OF NO2 CONCENTRATIONS (PPB)

MONTREAL: NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1979	958	15	24	34	42	51	70	33.7	83.8
1980	811	18	25	33	43	51	78	34.4	85.0
1981	468	10	16	22	29	38	56	23.2	73.2
1982	932	4	10	17	27	37	59	19.4	160.9

C2.3

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR NO2

MONTREAL: ALL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	NUMBER ACC 1HR	GREATER TOL 1HR	THAN DES 24HR	--- ACC 24HR
1979	9	72.5	88.8	140	0	0	0	0
1980	9	72.9	85.0	130	0	0	0	0
1981	9	49.7	98.0	270	5	0	0	0
1982	9	62.8	160.9	450	11	0	2	1

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR NO2

MONTREAL: RESIDENTIAL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	NUMBER ACC 1HR	GREATER TOL 1HR	THAN DES 24HR	--- ACC 24HR
1979	6	64.9	88.8	140	0	0	0	0
1980	6	72.5	77.1	130	0	0	0	0
1981	6	53.2	98.0	270	5	0	0	0
1982	5	61.6	112.2	400	3	0	1	0

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR NO2

MONTREAL: NONRESIDENTIAL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	NUMBER ACC 1HR	GREATER TOL 1HR	THAN DES 24HR	--- ACC 24HR
1979	3	87.7	83.8	140	0	0	0	0
1980	3	73.9	85.0	130	0	0	0	0
1981	3	42.9	73.2	150	0	0	0	0
1982	4	64.2	160.9	450	8	0	1	1

C3.1

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR OZONE
MONTREAL: ALL STATIONS

MEANS (PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1979	9.8	12.9	14.0	19.9	18.3	24.9	21.9	14.2	12.6	7.6	5.1	6.5	13.8	84.8
1980	9.0	10.1	17.3	16.1	19.3	24.9	18.0	13.2	11.2	7.6	6.2	5.5	13.5	82.6
1981	6.7	7.6	12.5	16.3	22.5	22.0	20.7	15.7	11.2	7.0	8.0	7.3	12.9	72.1
1982	10.7	13.9	19.8	27.7	25.4	19.2	23.1	16.1	10.5	6.9	4.8	.	16.9	67.7

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR OZONE
MONTREAL: RESIDENTIAL STATIONS

MEANS (PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVE
1979	11.5	13.7	15.7	20.0	18.1	27.9	26.9	17.0	14.0	8.8	5.9	7.7	15.4	80
1980	10.6	11.8	19.4	17.4	20.5	26.7	20.4	15.7	12.2	8.5	6.6	6.5	15.4	77
1981	8.1	7.9	13.6	19.4	25.2	26.6	24.3	18.1	10.9	6.9	8.1	6.4	14.0	72
1982	9.9	12.9	18.6	26.5	24.2	18.8	26.7	17.6	9.8	6.6	4.7	.	17.3	6

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR OZONE
MONTREAL: NONRESIDENTIAL STATIONS

MEANS (PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DAT RECOV
1979	8.4	12.1	12.5	19.8	18.4	21.0	16.2	10.9	10.9	6.6	4.2	4.9	12.0	
1980	7.2	8.0	14.2	14.4	17.4	22.1	14.3	9.8	9.9	6.7	5.8	4.6	11.1	
1981	5.4	7.3	10.9	16.1	20.5	16.4	15.5	12.4	11.6	7.2	7.8	9.0	11.2	
1982	12.0	14.5	21.8	29.4	27.2	19.9	18.0	13.6	11.1	7.0	4.9	.	16.3	

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF OZONE CONCENTRATIONS (PPB)

MONTREAL: ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1979	2769	2	5	11	20	28	56	13.8	115.0
1980	3017	2	6	12	19	26	48	13.5	90.4
1981	2620	2	5	11	18	25	52	12.9	82.3
1982	2211	3	8	15	24	32	53	16.9	72.0

PERCENTILE DISTRIBUTION OF OZONE CONCENTRATIONS (PPB)

MONTREAL: RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1979	1454	3	7	13	21	30	58	15.5	81.3
1980	1701	3	8	14	21	28	57	15.4	90.4
1981	1579	3	6	12	19	27	54	14.0	82.3
1982	1264	4	9	16	24	31	56	17.3	72.0

PERCENTILE DISTRIBUTION OF OZONE CONCENTRATIONS (PPB)

MONTREAL: NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1979	1315	1	4	8	18	25	47	12.0	115.0
1980	1316	0	4	9	16	23	42	11.1	68.8
1981	1041	2	4	9	16	22	46	11.1	60.8
1982	847	2	7	14	24	33	48	16.3	69.4

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR OZONE

MONTREAL: ALL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	—	NUMBER	GREATER	THAN	—
					DES 1HR	ACC 1HR	TOL 1HR	DES 24HR	ACC 24HR
1979	9	84.8	115.0	160	1909	262	2	1068	392
1980	10	82.6	90.4	170	1109	151	1	1165	362
1981	10	72.1	82.3	160	1326	208	1	872	262
1982	9	67.7	72.0	200	1549	164	4	1158	509

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR OZONE

MONTREAL: RESIDENTIAL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	—	NUMBER	GREATER	THAN	—
					DES 1HR	ACC 1HR	TOL 1HR	DES 24HR	ACC 24HR
1979	5	80.0	81.3	150	1275	155	1	658	248
1980	6	77.8	90.4	170	835	123	1	798	265
1981	6	72.3	82.3	160	1044	166	1	581	193
1982	5	69.6	72.0	200	844	95	4	699	280

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR OZONE

MONTREAL: NONRESIDENTIAL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	—	NUMBER	GREATER	THAN	—
					DES 1HR	ACC 1HR	TOL 1HR	DES 24HR	ACC 24HR
1979	4	90.8	115.0	160	634	107	1	410	144
1980	4	89.8	68.8	150	274	28	0	367	97
1981	4	71.6	60.8	120	282	42	0	291	69
1982	4	63.4	69.4	129	705	69	0	459	229

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR TSP
MONTREAL: ALL STATIONS

MEANS (UG/M3)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1971	.	.	.	138.5	116.5	125.6	93.9	122.2	84.3	96.5	90.0	119.9	108.6	53.3
1972	94.0	76.7	94.6	131.9	135.0	110.0	111.9	85.5	76.6	85.1	91.7	91.9	96.0	56.4
1973	102.1	88.3	141.2	99.0	90.7	80.4	120.8	101.6	88.3	94.4	117.8	93.1	100.4	75.4
1974	82.1	147.4	115.3	155.8	120.9	140.3	125.4	115.1	122.3	143.8	138.8	98.6	124.7	76.3
1975	99.2	115.3	123.0	148.0	110.4	111.8	96.6	89.7	79.7	97.5	83.7	78.2	100.6	71.9
1976	75.1	63.2	78.4	121.7	79.7	98.6	74.0	75.3	72.0	57.6	68.0	64.7	75.9	87.7
1977	53.5	53.9	81.1	100.6	94.2	60.9	65.9	84.4	64.7	54.2	72.3	58.6	68.6	75.2
1978	38.1	60.3	68.5	75.1	106.1	72.4	82.8	63.0	62.6	72.4	100.5	56.6	68.9	85.1
1979	50.3	66.9	83.4	59.8	81.3	81.8	63.1	56.7	79.3	61.3	54.6	59.7	65.4	85.8
1980	88.6	83.8	79.0	65.8	91.5	84.3	67.1	76.7	65.4	56.8	46.6	57.7	71.6	81.3
1981	73.9	76.2	107.3	64.1	61.5	56.2	51.0	62.7	61.6	46.4	47.2	54.2	64.6	59.9

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR TSP
MONTREAL: RESIDENTIAL STATIONS

MEANS (UG/M3)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1971	.	.	.	157.6	89.4	116.1	92.8	119.2	74.8	91.5	83.0	102.3	99.6	52.6
1972	84.7	58.5	94.0	134.1	137.8	97.0	88.6	74.3	75.4	92.1	80.5	103.9	92.9	68.9
1973	85.2	87.9	137.9	109.0	91.2	73.9	120.1	84.5	86.5	69.4	115.1	98.6	94.5	78.9
1974	89.9	157.4	121.9	154.7	106.4	109.8	87.2	88.3	106.3	112.4	104.4	93.5	113.2	63.3
1975	97.5	115.8	134.8	138.2	114.0	94.2	87.3	71.3	88.1	82.1	70.9	101.0	101.5	58.4
1976	66.3	59.8	81.0	114.9	70.2	88.8	64.0	84.6	58.7	52.6	56.1	59.3	67.9	85.9
1977	48.2	49.6	77.9	94.7	79.0	57.7	55.4	76.8	58.6	43.7	73.3	50.0	61.6	68.8
1978	33.6	44.5	52.6	64.4	93.2	55.9	68.7	48.6	45.2	60.9	84.8	37.6	54.8	79.7
1979	41.9	53.2	68.1	46.1	73.0	66.4	50.9	43.7	63.0	47.0	45.2	50.4	52.9	80.8
1980	72.7	63.7	63.7	55.6	69.0	74.2	53.2	62.4	56.2	45.7	34.6	45.7	57.6	84.1
1981	56.3	61.0	79.4	56.2	53.3	47.7	43.7	56.1	50.2	41.9	40.2	47.8	53.2	69.5

C4.1 cont'd.

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR TSP
MONTREAL: NONRESIDENTIAL STATIONS

MEANS (UG/M3)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1971	.	.	.	129.0	139.9	131.6	95.2	123.9	90.4	99.9	94.1	137.9	114.9	53.7
1972	100.2	87.9	95.0	127.7	133.5	117.1	132.2	92.1	77.0	82.5	97.3	86.4	97.6	51.5
1973	111.8	88.5	142.5	95.8	90.5	83.5	121.1	109.9	89.1	105.9	119.8	90.5	103.0	74.0
1974	79.6	145.1	112.6	156.3	125.9	165.3	134.8	120.1	131.3	156.2	142.6	99.7	128.5	81.5
1975	99.7	115.0	117.4	152.8	109.1	116.7	99.6	94.9	78.2	101.0	86.9	73.3	100.3	77.3
1976	82.2	66.8	75.9	128.6	90.1	108.2	87.6	86.1	86.7	62.6	82.4	72.4	84.5	74.6
1977	62.3	60.7	86.3	108.8	113.2	65.0	79.6	92.2	70.4	67.8	71.5	71.0	77.5	84.2
1978	42.9	81.7	86.0	88.1	119.0	85.8	97.9	79.5	81.9	83.1	116.2	81.2	84.4	90.4
1979	59.9	80.1	102.0	80.8	91.9	100.9	79.7	76.2	102.6	79.8	67.5	72.8	81.7	91.7
1980	110.5	112.7	95.5	77.2	118.4	98.5	85.2	94.7	78.5	74.1	69.4	74.3	90.3	78.5
1981	98.0	95.2	146.5	83.4	87.4	74.4	70.3	77.0	82.2	52.1	58.8	63.4	84.5	50.3

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF TSP CONCENTRATIONS (UG/M3)

MONTREAL: ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1971	162	60	78	103	148	215	346	108.6	377.0
1972	241	47	68	100	140	181	298	96.0	306.0
1973	321	49	72	102	145	197	338	100.4	808.0
1974	325	68	92	118	173	239	522	124.7	585.7
1975	306	59	75	95	136	187	367	100.6	412.8
1976	535	42	58	76	102	138	253	75.9	473.1
1977	549	33	48	65	98	139	327	68.6	999.0
1978	621	32	46	69	106	148	281	68.9	558.0
1979	574	33	45	63	92	141	278	65.4	446.0
1980	694	38	51	69	99	144	297	71.6	353.0
1981	510	32	44	62	92	143	289	64.6	474.0

PERCENTILE DISTRIBUTION OF TSP CONCENTRATIONS (UG/M3)

MONTREAL: RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1971	64	62	76	97	132	171	288	99.6	288.4
1972	84	46	70	90	134	169	293	92.9	293.0
1973	96	46	66	98	137	194	314	94.5	314.3
1974	77	67	89	110	145	201	279	113.2	279.2
1975	71	61	76	98	130	201	322	101.5	322.0
1976	262	35	50	67	93	129	213	67.9	270.9
1977	293	31	43	59	86	127	510	61.6	999.0
1978	291	28	38	55	77	112	223	54.8	377.0
1979	295	28	38	52	73	95	187	52.9	275.0
1980	359	33	43	56	78	103	168	57.6	174.0
1981	296	30	39	52	70	99	158	53.2	198.0

C4.2 cont'd.

PERCENTILE DISTRIBUTION OF TSP CONCENTRATIONS (UG/M3)

MONTREAL: NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1971	98	60	79	109	168	240	377	114.9	377.0
1972	157	48	66	103	147	199	304	97.6	306.0
1973	225	50	74	105	149	199	356	103.0	808.0
1974	248	68	93	123	182	245	554	128.5	585.7
1975	235	58	74	94	139	183	370	100.3	412.8
1976	273	49	64	82	111	154	268	84.5	473.1
1977	256	42	57	76	106	150	268	77.5	295.0
1978	330	41	61	82	120	175	311	84.4	558.0
1979	279	41	55	79	118	172	325	81.7	446.0
1980	335	52	64	86	128	177	341	90.3	353.0
1981	214	38	57	83	131	192	308	84.5	474.0

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR TSP

MONTREAL: ALL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (UG/M3)	NO. GREATER THAN TOL 24HR	NO. GREATER THAN ACC 24HR
1971	5	53.3	377.0	0	67
1972	7	56.4	306.0	0	90
1973	7	75.4	808.0	1	119
1974	7	76.3	585.7	5	159
1975	7	71.9	412.8	1	100
1976	10	87.7	473.1	1	89
1977	12	75.2	999.0	3	81
1978	12	85.1	558.0	1	104
1979	11	85.8	446.0	1	84
1980	14	81.3	353.0	0	116
1981	14	59.9	474.0	1	73

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR TSP

MONTREAL: RESIDENTIAL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (UG/M3)	NO. GREATER THAN TOL 24HR	NO. GREATER THAN ACC 24HR
1971	2	52.6	288.4	0	23
1972	2	68.9	293.0	0	28
1973	2	78.9	314.3	0	29
1974	2	63.3	279.2	0	30
1975	2	58.4	322.0	0	21
1976	5	85.9	270.9	0	32
1977	7	68.8	999.0	3	33
1978	6	79.7	377.0	0	22
1979	6	80.8	275.0	0	15
1980	7	84.1	174.0	0	20
1981	7	69.5	198.0	0	14

C4.3 cont'd.

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR TSP

MONTREAL: NONRESIDENTIAL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (UG/M3)	NO.GREATER THAN TOL 24HR	NO. GREATER THAN ACC 24HR
1971	3	53.7	377.0	0	44
1972	5	51.5	306.0	0	62
1973	5	74.0	808.0	1	90
1974	5	81.5	585.7	5	129
1975	5	77.3	412.8	1	79
1976	6	74.6	473.1	1	57
1977	5	84.2	295.0	0	48
1978	6	90.4	558.0	1	82
1979	5	91.7	446.0	1	69
1980	7	78.5	353.0	0	96
1981	7	50.3	474.0	1	59

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR CO
VANCOUVER: ALL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1974	2.7	1.8	1.6	2.0	1.5	1.7	2.3	1.4	2.1	2.6	2.2	1.3	2.0	81.3
1975	1.5	1.3	2.2	1.6	1.1	0.8	1.1	1.2	2.1	1.5	2.2	3.1	1.7	50.4
1976	2.2	1.5	0.8	0.6	0.4	0.8	0.7	0.8	1.5	1.8	3.1	1.8	1.4	79.2
1977	2.9	1.7	0.7	.	0.6	0.6	0.6	1.1	1.3	1.4	1.4	2.2	1.4	69.2
1978	1.9	1.4	1.2	1.0	1.1	1.3	1.1	1.2	1.4	2.0	2.2	1.7	1.5	74.0
1979	2.6	1.5	1.7	1.3	1.2	1.0	1.3	1.0	1.6	2.4	3.4	1.8	1.7	79.3
1980	2.3	1.5	1.4	1.0	0.9	1.0	1.1	1.5	1.8	2.4	2.0	1.9	1.6	54.4
1981	2.9	2.7	2.2	1.7	1.5	1.6	1.1	1.3	1.5	1.8	2.1	1.9	1.8	74.6

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF CO
VANCOUVER: RESIDENTIAL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1974	4.1	2.6	2.4	3.2	2.4	2.2	3.4	1.4	2.0	2.5	2.9	1.9	2.6	90.6
1975	.	.	.	.	0.7	0.2	.	.	2.2	.	.	3.2	1.5	27.8
1976	.	.	1.2	.	.	0.7	0.7	1.2	1.9	2.2	3.9	2.3	1.8	63.4
1977	3.3	2.1	1.0	.	0.7	0.8	0.8	1.1	1.3	1.5	1.3	2.3	1.6	52.6
1978	1.5	1.6	.	1.2	1.0	1.2	1.1	1.0	1.3	1.8	2.4	1.7	1.5	56.7
1979	.	1.9	1.6	1.1	1.4	1.2	1.1	1.3	1.7	2.9	4.2	2.2	1.9	82.9
1980	2.4	1.8	1.5	1.3	1.3	0.9	0.9	1.2	1.4	.	1.8	1.7	1.5	35.5
1981	2.4	2.5	1.9	1.5	1.3	0.6	0.8	1.0	1.3	1.4	1.7	1.8	1.5	90.8

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF CO
VANCOUVER: NONRESIDENTIAL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1974	1.5	0.8	0.5	0.8	0.7	1.0	0.9	.	2.2	2.6	1.7	0.8	1.2	71.9
1975	1.5	1.3	2.2	1.6	1.2	1.1	1.1	1.2	2.1	1.5	2.2	3.1	1.8	57.8
1976	2.2	1.8	0.6	0.6	0.4	0.9	0.6	0.8	1.4	1.7	2.8	1.7	1.4	84.4
1977	2.7	1.5	0.6	.	0.6	0.8	0.6	1.1	1.3	1.4	1.5	2.2	1.3	80.3
1978	2.2	1.2	1.2	1.0	1.1	1.3	1.1	1.3	1.5	2.2	2.1	1.7	1.5	85.6
1979	2.6	1.4	1.7	1.3	1.1	0.9	1.3	0.9	1.5	2.3	3.0	1.4	1.6	78.1
1980	1.8	1.2	1.3	0.9	0.8	1.0	1.1	1.5	1.8	2.4	2.1	2.0	1.6	67.0
1981	3.2	2.8	2.5	1.8	1.8	2.1	1.2	1.4	1.8	2.0	2.3	2.0	1.8	69.2

BEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF CO CONCENTRATIONS (PPM)

VANCOUVER: ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1974	577	0.4	0.8	1.7	2.9	3.8	6.3	2.0	7.9
1975	724	0.2	0.5	1.3	2.6	3.6	8.5	1.7	9.8
1976	1144	0.2	0.5	1.0	2.0	3.4	6.8	1.5	8.5
1977	1252	0.3	0.6	1.1	1.9	2.8	5.6	1.4	6.5
1978	1344	0.5	0.9	1.3	2.0	2.8	4.9	1.5	6.8
1979	1148	0.6	1.0	1.3	2.2	3.2	6.5	1.7	7.9
1980	991	0.6	0.9	1.4	2.0	2.8	4.8	1.6	6.7
1981	1096	0.6	0.9	1.5	2.3	3.4	6.1	1.8	10.1

PERCENTILE DISTRIBUTION OF CO CONCENTRATIONS (PPM)

VANCOUVER: RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1974	322	1.0	1.6	2.5	3.3	4.4	6.8	2.6	7.8
1975	100	0.1	0.3	0.8	2.4	3.5	8.6	1.6	8.6
1976	227	0.4	0.8	1.3	2.5	3.8	7.1	1.8	9.0
1977	381	0.5	0.8	1.3	2.0	3.3	5.9	1.6	6.5
1978	413	0.6	0.9	1.3	1.9	2.8	5.4	1.5	6.8
1979	299	0.9	1.1	1.5	2.2	3.6	7.6	1.9	7.9
1980	259	0.7	1.1	1.4	1.8	2.6	4.6	1.5	6.7
1981	334	0.8	0.9	1.3	1.8	2.7	4.5	1.5	5.4

PERCENTILE DISTRIBUTION OF CO CONCENTRATIONS (PPM)

VANCOUVER: NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1974	255	0.1	0.5	0.9	1.5	2.7	5.2	1.2	5.7
1975	624	0.2	0.5	1.4	2.6	3.7	8.2	1.8	9.8
1976	917	0.2	0.4	0.8	1.8	3.3	6.8	1.4	8.5
1977	871	0.2	0.5	1.0	1.8	2.8	5.3	1.3	6.1
1978	931	0.5	0.8	1.3	2.0	2.7	5.0	1.5	6.5
1979	849	0.5	0.9	1.3	2.1	3.0	6.2	1.6	7.4
1980	732	0.5	0.8	1.3	2.0	2.8	5.0	1.6	6.7
1981	782	0.8	1.0	1.6	2.6	3.7	6.5	1.9	10.1

SEIA TREND ANALYSIS

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR CO
VANCOUVER: ALL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)	NUMBER GREATER THAN DES 1HR	NUMBER GREATER THAN ACC 1HR
1974	2	81.3	7.9	22.0000	39	0
1975	4	50.4	9.8	22.0000	72	0
1976	4	79.2	8.5	20.0000	52	0
1977	5	69.2	6.5	20.0000	16	0
1978	5	74.0	7.8	19.0000	16	0
1979	4	79.3	7.9	25.0000	35	0
1980	5	54.4	6.7	16.0000	10	0
1981	4	74.6	10.1	30.8000	52	0

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR CO
VANCOUVER: RESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)	NUMBER GREATER THAN DES 1HR	NUMBER GREATER THAN ACC 1HR
1974	1	90.6	7.9	22.0000	36	0
1975	1	27.8	8.6	19.0000	20	0
1976	1	63.4	8.0	20.0000	15	0
1977	2	52.6	6.5	17.0000	5	0
1978	2	56.7	6.8	19.0000	9	0
1979	1	82.9	7.9	25.0000	18	0
1980	2	35.5	6.7	15.8000	3	0
1981	1	90.8	5.4	9.3000	0	0

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR CO
VANCOUVER: NONRESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)	NUMBER GREATER THAN DES 1HR	NUMBER GREATER THAN ACC 1HR
1974	1	71.9	5.7	15.0000	3	0
1975	3	57.9	9.8	22.0000	52	0
1976	3	84.4	8.5	20.0000	37	0
1977	3	80.3	6.1	20.0000	11	0
1978	3	85.6	7.8	16.0000	7	0
1979	3	78.1	7.4	20.0000	17	0
1980	3	67.0	6.7	16.0000	7	0
1981	3	69.2	10.1	30.8000	52	0

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR NO2
VANCOUVER: ALL STATIONS

MEANS (PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1978	23.3	20.3	22.2	15.4	18.3	28.3	25.1	18.9	18.7	27.6	20.1	19.6	21.6	61.5
1979	26.4	20.9	20.0	18.8	16.2	17.4	17.3	21.7	26.2	26.3	25.8	19.5	21.1	68.4
1980	23.1	23.7	20.4	22.6	22.1	17.6	16.2	19.1	22.6	26.7	20.7	22.8	21.5	70.1
1981	28.3	28.9	26.4	19.5	20.8	18.0	20.1	25.8	23.4	23.7	22.5	.	23.1	58.1

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR NO2
VANCOUVER: RESIDENTIAL STATIONS

MEANS (PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1978	18.7	18.3	20.1	13.5	15.1	27.0	21.2	19.8	17.8	23.1	16.8	18.3	18.7	67.1
1979	24.5	17.3	17.9	16.4	14.3	16.3	16.4	19.6	27.8	27.3	29.2	19.5	20.3	72.1
1980	23.2	24.8	21.9	21.3	18.7	15.8	15.5	17.4	22.3	27.2	20.7	22.0	21.0	72.2
1981	29.1	24.5	23.0	19.9	16.9	16.0	19.1	24.4	22.5	22.8	22.6	.	21.6	55.4

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR NO2
VANCOUVER: NONRESIDENTIAL STATIONS

MEANS (PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1978	28.8	23.8	28.1	20.3	21.8	29.0	27.5	17.8	20.1	31.3	24.4	21.4	25.0	55.9
1979	27.9	23.4	22.0	22.1	18.8	18.8	18.2	23.9	24.3	24.4	22.0	19.5	22.1	64.6
1980	22.9	22.7	19.3	23.9	24.8	19.0	16.8	20.9	22.7	26.2	20.8	23.4	21.9	68.3
1981	27.9	31.0	29.0	19.3	25.4	20.2	20.9	27.3	24.3	24.9	22.5	.	24.5	60.9

SEIA TREND ANALYSIS

PERCENTILE DISTRIBUTION OF NO2 CONCENTRATIONS (PPB)

VANCOUVER: ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1978	2215	9	14	21	27	35	54	21.6	116.0
1979	2481	9	13	20	27	35	55	21.1	85.9
1980	2848	11	15	20	26	33	51	21.4	72.4
1981	2131	11	15	21	29	36	61	23.0	90.4

PERCENTILE DISTRIBUTION OF NO2 CONCENTRATIONS (PPB)

VANCOUVER: RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1978	1206	7	12	18	24	31	45	18.7	67.6
1979	1311	8	12	19	26	33	58	20.2	85.9
1980	1335	12	15	20	25	30	51	20.9	72.4
1981	1023	10	15	20	28	34	56	21.5	67.0

PERCENTILE DISTRIBUTION OF NO2 CONCENTRATIONS (PPB)

VANCOUVER: NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1978	1009	13	18	23	30	39	61	25.0	116.0
1979	1170	10	14	21	28	36	52	22.0	73.8
1980	1513	10	15	21	28	35	51	21.9	70.5
1981	1108	12	16	23	30	38	66	24.4	90.4

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR NO2

VANCOUVER: ALL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	NUMBER	GREATER	THAN	---
					ACC 1HR	TOL 1HR	DES 24HR	ACC 24HR
1978	10	61.5	116.0	210	0	0	1	0
1979	10	68.4	85.9	245	1	0	0	0
1980	11	70.1	80.4	185	0	0	0	0
1981	10	58.1	90.4	194	0	0	0	0

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR NO2

VANCOUVER: RESIDENTIAL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	NUMBER	GREATER	THAN	---
					ACC 1HR	TOL 1HR	DES 24HR	ACC 24HR
1978	5	67.1	67.6	166	0	0	0	0
1979	5	72.1	85.9	245	1	0	0	0
1980	5	72.2	80.4	180	0	0	0	0
1981	5	55.4	67.0	180	0	0	0	0

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR NO2

VANCOUVER: NONRESIDENTIAL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	NUMBER	GREATER	THAN	---
					ACC 1HR	TOL 1HR	DES 24HR	ACC 24HR
1978	5	55.9	116.0	210	0	0	1	0
1979	5	64.6	75.7	179	0	0	0	0
1980	6	80.3	70.5	185	0	0	0	0
1981	5	60.9	90.4	194	0	0	0	0

O3.1

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR OZONE
VANCOUVER: ALL STATIONS

MEANS (PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1978	4.4	8.8	12.2	18.8	22.3	21.1	20.0	15.5	9.3	7.1	5.6	7.0	13.3	83.6
1979	4.0	13.3	13.6	20.1	23.4	21.5	17.8	16.8	13.2	8.2	4.6	9.9	14.0	85.0
1980	8.9	9.4	13.9	21.5	19.2	15.7	16.4	15.9	12.8	9.6	9.2	7.7	13.5	76.7
1981	6.1	9.2	18.5	20.1	19.8	21.2	17.1	21.5	16.6	9.3	11.0	.	15.6	60.3

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR OZONE
VANCOUVER: RESIDENTIAL STATIONS

MEANS (PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1978	5.5	9.2	11.7	19.5	23.1	22.5	21.6	18.6	9.9	8.0	6.3	7.6	14.2	82.5
1979	4.8	14.9	16.3	22.6	26.2	24.1	19.4	18.7	14.8	9.5	5.5	10.2	15.8	81.1
1980	10.5	11.1	16.0	24.8	22.5	17.9	19.8	17.9	13.3	11.7	11.3	9.9	15.9	85.9
1981	7.4	11.3	23.0	23.2	24.1	20.8	19.8	24.5	19.0	10.5	12.7	.	18.0	64.3

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR OZONE
VANCOUVER: NONRESIDENTIAL STATIONS

MEANS (PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1978	3.4	8.4	12.7	18.1	21.6	19.6	18.4	12.6	8.7	6.4	4.8	6.3	12.3	84.7
1979	3.3	12.0	10.9	17.3	20.7	19.5	16.2	15.0	11.8	7.1	3.7	9.7	12.3	88.9
1980	7.6	8.2	11.6	17.3	15.2	13.3	13.1	13.7	12.3	7.8	7.3	5.0	10.9	69.0
1981	4.3	6.5	11.9	16.0	15.6	21.8	14.0	18.0	13.6	8.2	9.6	.	12.7	56.3

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF OZONE CONCENTRATIONS (PPB)

VANCOUVER: ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1978	3033	2	5	12	19	26	42	13.3	74.3
1979	3086	2	6	13	20	27	39	14.0	64.5
1980	3110	3	6	12	18	26	44	13.5	86.7
1981	2229	4	8	13	21	29	53	15.5	74.6

PERCENTILE DISTRIBUTION OF OZONE CONCENTRATIONS (PPB)

VANCOUVER: RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1978	1493	2	6	13	21	27	49	14.2	74.3
1979	1473	2	7	15	23	30	43	15.8	64.5
1980	1585	4	8	14	21	30	51	15.9	86.7
1981	1188	4	9	16	25	33	58	17.9	74.6

PERCENTILE DISTRIBUTION OF OZONE CONCENTRATIONS (PPB)

VANCOUVER: NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1978	1540	2	5	11	18	25	36	12.3	53.0
1979	1613	2	6	12	18	23	33	12.3	43.1
1980	1525	2	5	10	15	21	31	11.0	50.6
1981	1041	3	7	11	17	22	43	12.7	70.5

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR OZONE

VANCOUVER: ALL STATIONS

YEAR	NO.OF	%DATA	MAX DLY	MAX HRLY	---	NUMBER	GREATER	THAN	---
	STATIONS	RECOVERY	MEAN	VALUE	DES	ACC	TOL	DES	ACC
			(PPB)	(PPB)	1HR	1HR	1HR	24HR	24HR
1978	10	83.6	74.3	182	1470	258	10	1217	370
1979	10	85.0	82.6	175	1591	208	6	1341	404
1980	11	76.7	86.7	245	1694	279	10	1172	354
1981	10	60.3	83.1	319	1621	459	62	1037	384

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR OZONE

VANCOUVER: RESIDENTIAL STATIONS

YEAR	NO.OF	%DATA	MAX DLY	MAX HRLY	---	NUMBER	GREATER	THAN	---
	STATIONS	RECOVERY	MEAN	VALUE	DES	ACC	TOL	DES	ACC
			(PPB)	(PPB)	1HR	1HR	1HR	24HR	24HR
1978	5	82.5	74.3	178	965	191	9	657	218
1979	5	81.1	82.6	175	1252	181	5	756	301
1980	5	85.9	86.7	245	1455	257	10	732	287
1981	5	64.3	74.6	285	1229	346	37	672	311

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR OZONE

VANCOUVER: NONRESIDENTIAL STATIONS

YEAR	NO.OF	%DATA	MAX DLY	MAX HRLY	---	NUMBER	GREATER	THAN	---
	STATIONS	RECOVERY	MEAN	VALUE	DES	ACC	TOL	DES	ACC
			(PPB)	(PPB)	1HR	1HR	1HR	24HR	24HR
1978	5	84.7	53.0	182	505	67	1	560	152
1979	5	88.9	43.1	160	339	27	1	585	103
1980	6	69.0	50.6	114	239	22	0	440	67
1981	5	56.3	83.1	319	392	113	25	365	73

D4.1

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR TSP
VANCOUVER: ALL STATIONS

MEANS (UG/M3)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1970	.	.	.	.	86.7	78.5	76.2	75.9	58.1	.	125.2	146.0	91.2	37.8
1971	97.2	121.8	96.0	74.3	79.1	54.1	89.6	92.6	73.2	73.4	.	.	84.0	55.9
1972	127.3	83.6	53.5	22.7	.	70.7	60.5	83.9	52.0	69.2	129.3	46.3	67.9	34.4
1973	58.3	97.6	74.6	77.4	58.1	39.8	70.9	59.6	82.7	77.3	54.7	64.0	65.0	76.4
1974	56.8	49.7	47.3	49.2	39.9	68.9	45.1	61.3	86.3	94.8	77.7	42.6	57.2	96.2
1975	56.6	61.0	53.2	61.6	46.2	49.4	59.1	7.3	77.4	42.3	47.5	46.1	45.1	75.6
1976	47.9	67.0	51.6	52.2	42.7	52.0	50.9	52.2	81.3	69.1	90.9	47.0	55.7	85.0
1977	99.3	63.4	37.9	76.0	55.3	80.9	53.8	79.8	58.1	58.7	41.0	71.0	63.6	87.0
1978	72.5	61.8	73.0	53.1	46.9	59.6	72.6	43.1	46.8	65.2	65.3	41.6	57.4	96.5
1979	101.7	54.6	62.2	55.9	53.2	64.6	50.6	61.4	60.1	77.7	77.5	37.4	62.0	95.1
1980	77.0	61.9	43.2	52.4	52.0	46.5	61.7	75.5	79.7	98.5	58.8	51.3	61.5	88.3
1981	93.6	59.6	53.1	38.0	53.5	39.5	52.7	58.6	47.3	48.7	56.4	36.2	51.2	86.4

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR TSP
VANCOUVER: RESIDENTIAL STATIONS

MEANS (UG/M3)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1970	.	.	.	.	86.7	78.5	76.2	75.9	58.1	.	125.2	146.0	91.2	37.8
1971	97.2	121.8	96.0	74.3	79.1	54.1	89.6	92.6	73.2	73.4	.	.	84.0	55.9
1972	127.3	83.6	53.5	22.7	.	70.7	60.5	83.9	52.0	69.2	129.3	46.3	67.9	34.4
1973	58.3	97.6	74.8	77.4	58.1	39.8	70.9	58.2	79.6	74.9	53.1	60.8	63.9	90.4
1974	54.7	46.4	47.4	48.4	40.1	68.4	45.3	62.9	85.9	96.4	83.1	41.8	57.1	95.9
1975	63.7	67.4	57.0	63.6	47.8	50.4	51.1	5.3	79.4	45.2	48.1	49.1	45.7	65.3
1976	55.1	64.4	63.6	48.8	42.2	50.5	47.5	52.1	79.0	87.8	106.3	46.1	56.0	80.3
1977	98.7	61.8	36.2	75.7	51.8	79.3	49.4	73.7	54.4	59.6	39.4	69.6	61.2	85.9
1978	71.7	56.6	67.5	48.0	41.7	52.1	63.7	39.7	44.2	62.3	64.5	38.7	53.1	96.6
1979	95.0	50.7	61.4	51.8	50.3	61.2	45.0	55.9	69.7	80.8	77.4	35.9	59.4	94.1
1980	78.1	59.8	42.9	52.3	48.2	46.3	59.0	70.8	75.0	103.0	55.9	50.5	60.1	92.6
1981	90.5	60.4	49.5	37.5	51.4	36.4	44.2	55.3	42.0	43.8	53.1	33.7	47.8	89.6

D4.1 cont'd.

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR TSP
VANCOUVER: NONRESIDENTIAL STATIONS

MEANS (UG/M3)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1973	.	.	.	.	.	.	.	63.9	94.6	86.5	60.0	81.8	74.4	34.5
1974	63.2	61.1	46.9	51.7	39.4	70.4	44.5	57.4	87.4	90.4	57.0	44.8	57.4	97.0
1975	47.7	52.5	48.2	58.3	44.7	48.4	73.3	11.9	70.1	38.3	46.1	43.4	44.3	64.1
1976	41.4	71.3	41.2	55.6	43.1	53.4	54.6	52.3	83.0	70.0	83.6	47.8	55.3	89.6
1977	99.9	65.1	39.4	76.9	60.8	83.2	60.3	88.2	63.2	57.7	43.5	72.8	66.7	90.4
1978	73.5	69.6	81.8	60.2	54.4	69.6	85.7	48.6	50.4	70.0	66.5	46.1	63.7	96.4
1979	111.2	60.0	63.3	62.8	56.4	69.9	58.3	69.2	66.2	74.1	77.6	39.3	65.4	96.4
1980	75.5	64.9	43.7	52.4	56.0	46.6	67.3	84.9	88.5	92.9	63.5	52.3	63.6	82.5
1981	97.8	57.6	61.7	39.0	57.4	44.2	66.8	63.1	54.1	54.9	61.3	39.7	56.5	82.2

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF TSP CONCENTRATIONS (UG/M3)

VANCOUVER: ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1970	46	40	71	96	130	165	235	91.2	234.9
1971	68	43	58	81	120	169	275	84.0	274.8
1972	42	33	50	69	94	132	398	67.9	398.1
1973	186	36	47	65	87	120	202	65.0	226.9
1974	234	32	39	55	79	121	191	57.2	203.6
1975	276	26	35	51	74	101	190	45.1	241.0
1976	311	30	43	58	81	113	191	55.7	269.0
1977	374	33	45	61	91	125	202	63.6	223.0
1978	411	31	40	59	79	107	168	57.4	223.0
1979	405	31	44	62	85	128	202	62.0	276.0
1980	377	35	45	61	85	105	180	61.5	272.0
1981	368	28	37	50	72	106	178	51.2	216.0

PERCENTILE DISTRIBUTION OF TSP CONCENTRATIONS (UG/M3)

VANCOUVER: RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1970	46	40	71	96	130	165	235	91.2	234.9
1971	68	43	58	81	120	169	275	84.0	274.8
1972	42	33	50	69	94	132	398	67.9	398.1
1973	165	35	45	64	86	120	208	63.9	226.9
1974	175	31	39	55	79	118	196	57.1	203.6
1975	159	27	36	54	78	103	237	45.7	241.0
1976	147	30	41	57	81	114	236	56.0	269.0
1977	209	32	42	58	89	125	179	61.2	203.0
1978	235	30	38	54	72	87	166	53.1	179.0
1979	229	29	42	59	84	126	198	59.4	213.0
1980	226	36	45	59	83	103	182	60.1	201.0
1981	218	26	33	46	64	103	166	47.8	216.0

D4.2 cont'd.

PERCENTILE DISTRIBUTION OF TSP CONCENTRATIONS (UG/M3)

VANCOUVER: NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1973	21	48	57	75	95	121	155	74.4	154.9
1974	59	32	40	54	89	137	181	57.4	181.3
1975	117	23	34	47	65	93	171	44.3	175.0
1976	164	31	44	58	81	113	184	55.3	193.0
1977	165	36	48	68	91	123	214	66.7	223.0
1978	176	31	47	63	91	122	207	63.7	223.0
1979	176	32	46	66	89	148	260	65.4	276.0
1980	151	33	46	65	87	109	210	63.6	272.0
1981	150	28	39	57	78	114	201	56.5	208.0

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR TSP

VANCOUVER: ALL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (UG/M3)	NO. GREATER THAN TOL 24HR	NO. GREATER THAN ACC 24HR
1970	2	37.8	234.9	0	14
1971	2	55.9	274.8	0	17
1972	2	34.4	398.1	0	5
1973	4	76.4	226.9	0	19
1974	4	96.2	203.6	0	24
1975	6	75.6	241.0	0	13
1976	6	85.0	269.0	0	25
1977	7	87.8	223.0	0	43
1978	7	96.5	223.0	0	32
1979	7	95.1	276.0	0	55
1980	7	88.3	272.0	0	23
1981	7	86.4	216.0	0	21

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR TSP

VANCOUVER: RESIDENTIAL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (UG/M3)	NO. GREATER THAN TOL 24HR	NO. GREATER THAN ACC 24HR
1970	2	37.8	234.9	0	14
1971	2	55.9	274.8	0	17
1972	2	34.4	398.1	0	5
1973	3	90.4	226.9	0	17
1974	3	95.9	203.6	0	16
1975	4	65.3	241.0	0	9
1976	3	80.3	269.0	0	12
1977	4	85.9	203.0	0	26
1978	4	96.6	179.0	0	13
1979	4	94.1	213.0	0	29
1980	4	92.6	201.0	0	12
1981	4	89.6	216.0	0	9

D4.3 cont'd.

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR TSP

VANCOUVER: NONRESIDENTIAL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (UG/M3)	NO.GREATER THAN TOL 24HR	NO. GREATER THAN ACC 24HR
1973	1	34.5	154.9	0	2
1974	1	97.0	181.3	0	8
1975	3	64.1	175.0	0	4
1976	3	89.6	193.0	0	13
1977	3	90.4	223.0	0	17
1978	3	96.4	223.0	0	19
1979	3	96.4	276.0	0	26
1980	3	82.5	272.0	0	11
1981	3	82.2	208.0	0	12

SYNCSOR

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR CO
EDMONTON : ALL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1971	1.7	2.0	1.2	1.2	1.1	2.6	1.8	1.3	1.5	1.7	.	.	1.6	75.9
1972	.	.	.	.	.	.	.	.	.	.	.	2.0	2.0	8.5
1973	2.3	1.8	1.9	1.5	1.5	1.6	1.7	1.8	1.6	1.6	1.9	2.3	1.8	98.9
1974	1.5	1.5	1.2	1.5	1.6	1.6	0.7	0.8	1.1	1.6	1.8	1.9	1.4	79.3
1975	1.7	1.4	1.4	1.2	1.2	1.2	1.4	1.3	1.8	1.9	1.9	1.8	1.6	77.9
1976	2.1	1.6	1.4	1.1	1.1	0.9	1.2	1.1	1.6	1.5	1.2	1.7	1.4	73.9
1977	1.6	1.9	1.4	1.3	1.2	0.9	1.1	1.1	1.4	1.9	2.1	2.1	1.5	94.8
1978	2.0	1.9	1.3	1.0	1.0	1.1	0.9	1.3	1.6	1.7	1.8	2.0	1.5	97.8
1979	2.5	2.4	2.8	1.8	1.5	1.7	1.5	1.4	2.1	2.5	3.1	2.9	2.2	94.0
1980	2.9	2.6	2.5	1.9	1.9	1.9	1.6	1.5	1.9	2.4	2.5	2.1	2.1	95.8
1981	2.8	2.4	2.2	1.5	1.0	1.2	1.2	1.2	1.5	1.6	2.2	2.1	1.7	96.5
1982	2.2	2.4	2.3	1.7	1.1	1.2	1.5	1.4	1.5	2.2	2.3	.	1.8	88.8

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF CO
EDMONTON : RESIDENTIAL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1974	.	.	.	.	.	.	0.3	0.5	0.7	1.5	1.9	2.3	1.2	49.2
1975	2.2	1.9	1.5	1.0	0.9	0.9	1.5	1.4	2.0	2.3	1.9	2.5	1.6	93.6
1976	2.6	2.1	2.2	1.6	1.9	1.3	1.7	1.6	2.8	2.0	1.2	1.5	1.9	97.9
1977	1.5	2.3	1.8	1.4	0.7	0.7	0.9	1.0	1.0	2.3	2.6	1.8	1.5	92.2
1978	2.0	1.8	1.0	0.6	1.2	0.9	0.7	1.4	1.4	1.9	1.6	1.5	1.3	97.0
1979	1.8	1.1	2.3	1.1	1.0	1.3	1.4	1.3	.	2.2	2.9	2.8	1.8	86.8
1980	2.3	2.1	1.6	1.2	1.1	1.3	1.4	1.4	1.9	2.5	2.5	2.1	1.8	94.3
1981	3.3	2.7	1.9	1.2	0.7	0.8	0.6	1.0	1.6	1.5	2.2	2.0	1.6	96.5

E1.1 cont'd.

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF CO
EDMONTON : NONRESIDENTIAL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1971	1.7	2.0	1.2	1.2	1.1	2.6	1.8	1.3	1.5	1.7	.	.	1.6	75.9
1972	.	.	.	.	.	.	.	.	.	.	.	2.0	2.0	8.5
1973	2.3	1.8	1.9	1.5	1.5	1.6	1.7	1.8	1.6	1.6	1.9	2.3	1.8	98.9
1974	1.5	1.5	1.2	1.5	1.6	1.6	0.8	0.9	1.3	1.7	1.7	1.6	1.4	94.4
1975	1.5	1.2	1.4	1.3	1.6	1.4	1.4	1.3	1.7	1.6	1.9	1.5	1.5	70.0
1976	1.9	1.3	1.0	0.9	0.8	0.8	1.0	0.9	1.0	1.2	1.2	1.8	1.1	65.9
1977	1.6	1.8	1.4	1.3	1.3	1.0	1.2	1.2	1.5	1.8	1.9	2.2	1.5	95.7
1978	2.0	1.9	1.3	1.0	1.0	1.2	1.0	1.3	1.5	1.7	1.8	2.1	1.5	98.0
1979	2.7	2.8	2.9	2.0	1.6	1.8	1.5	1.4	2.1	2.5	3.2	2.9	2.3	96.4
1980	3.1	2.8	2.8	2.1	2.2	2.0	1.6	1.5	1.9	2.3	2.5	2.1	2.2	96.3
1981	2.6	2.4	2.2	1.6	1.1	1.3	1.4	1.3	1.5	1.6	2.2	2.1	1.8	95.5
1982	2.2	2.4	2.3	1.7	1.1	1.2	1.5	1.4	1.5	2.2	2.3	.	1.8	88.8

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF CO CONCENTRATIONS (PPM)

EDMONTON : ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1971	276	0.8	1.0	1.4	1.9	2.6	4.9	1.6	6.5
1972	31	0.7	1.0	1.6	2.9	3.8	4.2	2.0	4.2
1973	360	0.9	1.3	1.7	2.1	2.8	4.8	1.8	6.1
1974	851	0.2	0.6	1.2	2.0	2.7	4.8	1.4	5.6
1975	838	0.6	0.9	1.4	2.0	2.8	4.5	1.6	5.9
1976	1074	0.4	0.7	1.3	1.8	2.7	4.5	1.4	6.1
1977	1380	0.3	0.6	1.4	2.2	2.9	5.5	1.5	7.6
1978	1425	0.2	0.6	1.3	2.0	2.9	5.3	1.5	6.6
1979	1361	0.3	0.7	1.9	3.1	4.6	7.5	2.2	8.9
1980	1413	0.5	1.0	2.0	3.0	3.9	6.7	2.1	7.9
1981	1442	0.6	0.9	1.4	2.3	3.1	5.9	1.7	8.9
1982	331	0.8	1.2	1.6	2.2	2.9	5.3	1.8	6.1

PERCENTILE DISTRIBUTION OF CO CONCENTRATIONS (PPM)

EDMONTON : RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1974	179	0.0	0.3	1.0	1.8	3.0	5.5	1.2	5.6
1975	334	0.7	1.0	1.4	2.2	3.2	4.5	1.7	5.9
1976	358	0.7	1.1	1.6	2.4	3.4	4.9	1.9	6.1
1977	333	0.5	0.8	1.1	1.8	3.1	5.9	1.5	7.6
1978	350	0.4	0.6	1.1	1.7	2.8	4.9	1.3	5.7
1979	313	0.6	1.0	1.4	2.2	3.3	6.8	1.8	7.6
1980	348	0.8	1.1	1.5	2.3	3.3	5.2	1.8	6.1
1981	362	0.4	0.8	1.2	2.1	3.2	7.5	1.6	8.8

E1.2 cont'd.

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF CO CONCENTRATIONS (PPM)

EDMONTON : NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1971	276	0.8	1.0	1.4	1.9	2.6	4.9	1.6	6.5
1972	31	0.7	1.0	1.6	2.9	3.8	4.2	2.0	4.2
1973	360	0.9	1.3	1.7	2.1	2.8	4.8	1.8	6.1
1974	672	0.2	0.7	1.3	2.0	2.7	4.6	1.4	5.3
1975	504	0.5	0.9	1.4	1.9	2.6	4.7	1.5	5.2
1976	716	0.2	0.6	1.0	1.5	2.2	3.8	1.2	4.6
1977	1047	0.2	0.5	1.5	2.2	2.9	5.3	1.5	7.4
1978	1075	0.1	0.5	1.4	2.1	3.0	5.5	1.5	6.6
1979	1048	0.2	0.5	2.1	3.5	4.8	7.7	2.3	8.9
1980	1065	0.5	1.0	2.2	3.2	4.1	6.9	2.2	7.9
1981	1080	0.7	1.0	1.5	2.3	3.1	5.7	1.8	8.9
1982	331	0.8	1.2	1.6	2.2	2.9	5.3	1.8	6.1

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR CO
EDMONTON : ALL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)	NUMBER GREATER THAN DES 1HR	NUMBER GREATER THAN ACC 1HR
1971	1	75.9	6.5	27.0000	8	0
1972	1	8.5	4.2	12.5000	0	0
1973	1	98.9	6.1	21.0000	9	0
1974	3	79.3	5.6	20.0000	18	0
1975	3	77.9	5.9	17.0000	7	0
1976	4	73.9	7.5	35.5000	15	1
1977	4	94.8	7.6	28.0000	53	0
1978	4	97.8	6.6	25.0000	33	0
1979	4	94.0	8.9	30.0000	124	0
1980	4	95.8	7.9	23.6000	68	0
1981	4	96.5	8.9	29.8000	79	0
1982	1	88.6	6.1	15.4000	5	0

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR CO
EDMONTON : RESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)	NUMBER GREATER THAN DES 1HR	NUMBER GREATER THAN ACC 1HR
1974	1	49.2	5.6	17.0000	8	0
1975	1	93.6	5.9	14.0000	2	0
1976	1	97.9	7.5	35.5000	10	1
1977	1	92.2	7.6	28.0000	37	0
1978	1	97.0	5.7	25.0000	19	0
1979	1	86.8	7.6	30.0000	28	0
1980	1	94.3	6.1	23.6000	16	0
1981	1	96.5	8.8	29.8000	41	0

E1.3 cont'd.

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR CO
EDMONTON : NONRESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)	NUMBER GREATER THAN DES 1HR	NUMBER GREATER THAN ACC 1HR
1971	1	75.9	6.5	27.0000	8	0
1972	1	8.5	4.2	12.5000	0	0
1973	1	98.9	6.1	21.0000	9	0
1974	2	94.4	5.3	20.0000	10	0
1975	2	70.0	5.2	17.0000	5	0
1976	3	65.9	4.6	16.5000	5	0
1977	3	95.7	7.4	17.5000	16	0
1978	3	98.0	6.6	20.0000	14	0
1979	3	96.4	8.9	28.0000	96	0
1980	3	96.3	7.9	22.0000	52	0
1981	3	96.5	8.9	21.7000	38	0
1982	1	88.8	6.1	15.4000	5	0

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR NO2
EDMONTON : ALL STATIONS

MEANS(PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1975	39.6	48.0	36.3	31.9	25.6	16.6	28.9	28.0	37.6	42.8	45.6	53.4	37.7	78.8
1976	57.2	51.8	55.1	49.4	42.4	38.7	31.6	20.0	24.6	25.8	27.0	34.8	38.4	65.9
1977	36.0	40.9	41.7	42.5	29.7	30.1	24.6	26.0	23.3	34.6	36.1	39.7	33.3	89.6
1978	44.9	49.6	44.1	32.2	32.9	35.6	35.2	36.1	28.4	36.0	34.8	43.3	37.6	97.6
1979	43.8	33.5	43.0	45.7	34.6	37.3	36.0	32.1	34.2	36.2	41.6	37.5	37.9	86.9
1980	37.7	39.2	39.3	34.9	30.2	26.5	26.9	25.6	25.8	29.0	26.6	31.3	31.9	80.8
1981	56.0	46.0	45.0	33.1	30.7	27.8	31.2	39.6	37.5	37.7	26.8	38.3	36.6	86.4

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF NO2
EDMONTON : RESIDENTIAL STATIONS

MEANS(PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1975	35.4	43.6	36.3	31.9	25.6	16.6	19.1	16.6	26.4	29.6	33.9	40.5	29.6	57.1
1976	41.1	34.0	33.8	22.6	23.9	20.3	15.6	15.7	17.1	24.1	19.3	19.6	24.6	96.7
1977	19.2	30.9	.	.	15.1	18.5	17.1	8.6	12.6	18.0	26.2	22.8	18.6	73.2
1978	35.0	34.5	26.9	16.2	20.2	19.2	16.8	20.6	22.8	35.7	38.8	41.4	27.3	97.2
1979	47.8	31.8	33.3	23.1	27.4	23.6	23.1	20.7	25.4	28.4	33.7	36.3	29.2	95.5
1980	29.1	32.3	30.4	25.8	21.3	21.6	23.5	21.0	20.3	18.2	19.1	15.1	23.2	97.2
1981	.	39.1	42.9	29.6	29.0	25.5	23.8	27.5	30.5	.	18.7	35.1	30.0	77.2

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF NO2
EDMONTON : NONRESIDENTIAL STATIONS

MEANS(PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1975	45.6	52.4	.	.	.	.	38.8	38.2	49.1	58.4	56.7	57.3	50.9	60.5
1976	74.6	71.2	75.9	70.4	62.4	57.4	48.5	25.5	30.2	27.7	35.4	42.8	51.6	50.6
1977	44.5	45.9	41.7	42.5	36.0	35.3	28.7	34.6	28.7	43.1	39.1	48.2	39.1	96.3
1978	49.6	55.6	52.8	40.3	39.2	43.3	44.4	43.9	31.3	36.2	33.0	44.3	42.6	97.8
1979	42.1	34.1	52.9	67.6	37.8	44.2	40.1	37.6	38.6	40.5	45.5	36.0	42.1	87.6
1980	42.1	42.7	43.9	39.6	34.7	29.1	30.3	30.0	31.4	39.8	33.9	47.9	37.6	72.7
1981	56.0	55.2	47.1	36.6	32.3	30.0	38.5	51.8	44.1	37.7	34.7	41.3	41.9	35.8

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF NO2 CONCENTRATIONS (PPB)

EDMONTON : ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1975	568	16	24	35	48	62	87	37.5	111.4
1976	724	14	20	34	50	70	104	38.3	116.5
1977	977	13	23	34	44	50	70	33.4	82.5
1978	1068	18	28	39	46	56	91	37.7	89.8
1979	930	20	29	38	43	53	96	37.9	124.6
1980	899	16	22	31	39	46	77	31.7	105.0
1981	647	20	26	35	45	54	71	35.4	97.0

PERCENTILE DISTRIBUTION OF NO2 CONCENTRATIONS (PPB)

EDMONTON : RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1975	351	14	19	26	37	49	67	29.6	88.3
1976	354	11	16	22	31	41	60	24.5	63.3
1977	272	7	11	19	24	33	53	18.5	57.1
1978	354	12	17	25	36	45	64	27.3	66.7
1979	304	13	20	27	36	42	65	29.2	73.6
1980	363	11	17	23	29	35	50	23.1	60.0
1981	289	17	22	28	36	47	68	29.9	66.6

PERCENTILE DISTRIBUTION OF NO2 CONCENTRATIONS (PPB)

EDMONTON : NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1975	217	32	39	46	61	73	96	50.4	111.4
1976	370	28	35	48	66	80	108	51.5	116.5
1977	704	26	31	39	46	54	70	39.1	82.5
1978	714	29	35	42	50	60	82	42.9	89.8
1979	626	28	34	41	48	56	110	42.1	124.6
1980	536	24	29	36	44	52	85	37.5	105.0
1981	358	26	33	41	48	59	83	41.7	97.0

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR NO2
EDMONTON : ALL STATIONS

YEAR	NO. OF STNS	% DATA RECOV.	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	NO. ACC 1HR	GREATER TOL 1HR	THAN DES 24-R	--- ACC 24-R
1975	2	78.8	111.4	253.000	4	0	1	0
1976	3	65.9	116.5	220.000	3	0	3	0
1977	3	89.6	82.5	180.000	0	0	0	0
1978	3	97.6	89.6	170.000	0	0	0	0
1979	3	80.9	124.6	190.000	0	0	6	0
1980	3	80.8	105.0	220.000	2	0	0	0
1981	2	86.4	97.0	229.000	1	0	0	0

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR NO2
EDMONTON : RESIDENTIAL STATIONS

YEAR	NO. OF STNS	% DATA RECOV.	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	NO. ACC 1HR	GREATER TOL 1HR	THAN DES 24-R	--- ACC 24-R
1975	1	97.1	86.3	120.000	0	0	0	0
1976	1	96.7	63.3	120.000	0	0	0	0
1977	1	76.2	57.1	110.000	0	0	0	0
1978	1	97.2	86.7	150.000	0	0	0	0
1979	1	65.5	73.8	120.000	0	0	0	0
1980	1	97.2	60.0	197.000	0	0	0	0
1981	1	77.2	68.8	145.000	0	0	0	0

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR NO2
EDMONTON : NONRESIDENTIAL STATIONS

YEAR	NO. OF STNS	% DATA RECOV.	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	NO. ACC 1HR	GREATER TOL 1HR	THAN DES 24-R	--- ACC 24-R
1975	1	60.5	111.4	253.000	4	0	1	0
1976	2	50.6	116.5	220.000	3	0	3	0
1977	2	96.3	82.5	180.000	0	0	0	0
1978	2	97.8	89.6	170.000	0	0	0	0
1979	2	87.6	124.6	190.000	0	0	6	0
1980	2	72.7	105.0	220.000	2	0	0	0
1981	1	95.6	97.0	229.000	1	0	0	0

E3.1

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR OZONE
EDMONTON : ALL STATIONS

MEANS(PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1978	8.2	11.0	14.7	17.3	18.8	20.6	15.5	9.5	7.0	7.6	6.0	8.3	12.1	94.9
1979	6.3	10.8	15.2	26.4	27.1	23.6	19.6	13.1	11.5	8.0	4.7	4.0	14.5	92.3
1980	7.1	10.7	17.2	22.1	22.9	20.0	15.2	11.7	8.2	6.0	5.6	8.5	13.0	94.4
1981	5.9	9.0	15.0	20.0	20.1	19.5	20.9	23.4	12.0	8.8	5.6	8.7	14.1	94.3
1982	9.8	13.0	12.7	21.1	26.0	26.2	18.5	13.5	9.6	6.6	6.8	.	14.9	87.2

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF OZONE
EDMONTON : RESIDENTIAL STATIONS

MEANS(PPB)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1978	9.1	13.6	20.2	24.1	26.4	28.6	21.7	14.6	8.6	10.4	10.8	12.0	16.6	93.3
1979	9.9	16.5	23.3	30.7	31.6	31.9	24.5	16.8	16.8	12.9	7.6	5.9	19.5	89.3
1980	10.0	13.6	23.5	29.1	25.4	23.0	17.3	11.7	7.8	6.4	6.7	10.2	15.3	92.7
1981	7.0	12.2	17.9	22.9	28.7	24.9	26.5	30.2	16.0	11.5	6.1	11.0	17.9	92.2

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF OZONE
EDMONTON : NONRESIDENTIAL STATIONS

MEANS(PPC)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1978	7.6	9.5	12.1	14.2	15.2	16.9	12.4	7.0	6.2	6.2	4.2	6.5	9.8	95.7
1979	4.8	8.5	11.4	24.1	24.9	19.4	17.2	11.3	9.1	5.7	3.0	3.1	12.1	93.8
1980	5.7	9.3	14.4	18.8	21.7	18.6	14.0	11.7	8.4	5.8	5.0	7.6	11.9	95.3
1981	5.3	7.5	14.0	18.5	16.0	16.8	18.1	20.1	10.0	7.4	5.4	7.5	12.3	95.4
1982	9.8	13.0	12.7	21.1	26.0	26.2	18.5	13.5	9.6	6.6	6.8	.	14.9	87.2

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF OZONE CONCENTRATIONS (PPB)

EDMONTON : ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1978	1023	3	6	11	16	23	34	12.1	47.7
1979	992	2	6	12	22	29	44	14.5	64.4
1980	1048	3	6	11	18	25	37	13.0	46.3
1981	1072	3	7	12	20	27	40	14.1	54.2
1982	329	4	8	13	21	28	40	14.9	42.9

PERCENTILE DISTRIBUTION OF OZONE CONCENTRATIONS (PPB)

EDMONTON : RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1978	334	4	9	16	24	29	45	16.6	47.7
1979	312	3	11	19	28	35	53	19.7	64.4
1980	340	4	7	13	22	29	40	15.1	46.3
1981	350	3	9	18	26	31	50	17.9	54.2

PERCENTILE DISTRIBUTION OF OZONE CONCENTRATIONS (PPB)

EDMONTON : NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1978	689	2	5	10	14	17	23	9.9	30.0
1979	680	2	5	11	17	25	36	12.1	41.5
1980	708	3	6	11	16	23	35	11.9	38.1
1981	722	3	6	11	17	22	35	12.3	41.1
1982	329	4	8	13	21	28	40	14.9	42.9

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR OZONE
EDMONTON : ALL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	---	NUMBER	GREATER	THAN	---
					DES 1HR	ACC 1HR	TOL 1HR	DES 24HR	ACC 24HR
1978	3	94.9	47.7	105	107	13	0	312	86
1979	3	92.3	64.4	155	403	32	1	421	163
1980	3	94.4	46.3	75	190	0	0	399	107
1981	2	94.3	54.2	135	392	32	0	444	148
1982	1	87.2	42.9	86	87	4	0	140	47

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR OZONE
EDMONTON : RESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	---	NUMBER	GREATER	THAN	---
					DES 1HR	ACC 1HR	TOL 1HR	DES 24HR	ACC 24HR
1978	1	93.3	47.7	105	101	13	0	191	82
1979	1	89.3	64.4	155	309	32	1	215	103
1980	1	92.7	46.3	75	146	0	0	165	67
1981	1	92.2	54.2	135	308	28	0	210	98

SYNCSORT US PATENT # 4210961 COPY

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR OZONE
EDMONTON : NONRESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPB)	MAX HRLY VALUE (PPB)	---	NUMBER	GREATER	THAN	---
					DES 1HR	ACC 1HR	TOL 1HR	DES 24HR	ACC 24HR
1978	2	95.7	30.0	70	6	0	0	121	4
1979	2	93.8	41.5	65	94	0	0	206	60
1980	2	95.3	38.1	70	44	0	0	234	40
1981	2	95.4	41.1	85	84	4	0	234	50
1982	1	87.2	42.9	86	87	4	0	140	47

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR THE EDMONTON : ALL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1974	.	.	.	.	.	.	.	.	.	4.44	2.85	2.59	3.25	22.5
1975	1.62	2.64	.	.	.	.	4.63	3.41	2.31	3.08	14.83	4.44	4.20	49.2
1976	2.40	2.56	2.19	2.58	2.18	1.97	1.89	2.23	2.61	2.34	2.21	2.25	2.28	83.5
1977	2.64	2.39	2.10	2.10	2.04	2.05	2.12	2.12	2.17	2.29	2.32	2.49	2.23	53.0
1978	2.92	2.32	2.64	2.64	2.17	2.22	2.30	2.66	2.55	2.64	3.66	3.10	2.75	84.3
1979	2.59	2.62	2.53	2.80	2.35	1.59	1.98	2.06	2.39	2.05	2.00	2.43	2.33	84.7
1980	2.34	2.31	2.42	2.45	2.12	2.07	2.30	1.83	2.00	2.13	2.14	2.02	2.24	55.2
1981	2.44	2.10	2.09	1.87	1.77	1.76	1.93	2.22	2.27	2.39	2.59	2.52	2.18	95.1
1982	1.84	2.03	2.08	1.94	1.65	2.04	2.05	2.19	2.19	2.75	3.44	.	2.20	95.1

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF THE EDMONTON : RESIDENTIAL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1976	2.33	2.14	2.04	2.10	1.85	2.10	1.88	2.59	3.56	2.84	2.29	2.18	2.35	93.5
1977	2.89	2.39	1.85	1.95	1.87	2.13	2.09	1.94	1.89	2.24	1.95	1.88	2.11	92.9
1978	2.47	2.51	2.23	2.22	2.03	1.89	2.23	2.55	2.35	2.77	2.37	2.32	2.39	92.7
1979	2.52	2.16	2.73	2.39	2.35	1.81	2.51	2.22	2.34	2.24	2.24	3.53	2.44	75.7
1980	3.03	3.37	3.10	2.64	1.93	2.02	.	.	.	.	.	.	2.34	44.1

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS OF THE EDMONTON : NONRESIDENTIAL STATIONS

MEANS(PPM)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	%DATA RECOVERY
1974	.	.	.	.	.	.	.	.	.	4.44	2.88	2.59	3.25	22.5
1975	1.62	2.64	.	.	.	.	4.63	3.41	2.31	3.08	14.63	4.44	4.20	49.2
1976	2.44	2.55	2.25	2.78	2.28	1.90	1.88	2.10	2.15	2.10	2.17	2.30	2.24	83.5
1977	2.39	2.38	2.26	2.24	2.13	1.99	2.14	2.20	2.26	2.32	2.49	2.71	2.30	78.1
1978	3.09	2.21	3.32	3.16	2.23	2.29	2.34	2.54	2.55	3.02	4.75	3.51	2.93	95.5
1979	2.59	2.89	3.05	3.04	2.35	1.59	1.73	2.00	2.42	1.95	1.96	2.02	2.29	87.2
1980	2.00	1.92	2.03	2.41	2.23	2.11	2.30	1.98	2.00	2.13	2.14	2.02	2.11	65.9
1981	2.44	2.10	2.09	1.87	1.77	1.76	1.93	2.22	2.27	2.38	2.59	2.52	2.18	95.1
1982	1.84	2.03	2.08	1.94	1.65	2.04	2.05	2.19	2.19	2.75	3.44	.	2.20	95.1

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF THC CONCENTRATIONS (PPM)

EDMONTON : ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1974	81	1.97	2.15	3.00	3.62	5.14	12.29	3.25	12.29
1975	156	1.50	1.96	2.48	4.44	8.61	21.23	4.19	21.54
1976	892	1.80	1.96	2.09	2.36	2.94	5.94	2.29	15.06
1977	891	1.75	1.91	2.05	2.28	2.83	4.75	2.23	14.41
1978	1021	1.79	1.97	2.19	2.57	3.21	17.49	2.76	51.59
1979	906	1.32	1.58	2.11	2.55	3.21	6.79	2.33	45.62
1980	637	1.50	1.73	2.01	2.38	3.13	6.94	2.23	11.23
1981	351	1.69	1.87	2.13	2.40	2.71	3.71	2.19	4.15
1982	312	1.70	1.90	2.08	2.32	2.76	4.91	2.20	5.73

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF THC CONCENTRATIONS (PPM)

EDMONTON : RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1976	290	1.89	1.95	2.15	2.58	3.32	4.16	2.36	4.33
1977	329	1.72	1.87	2.05	2.22	2.57	3.86	2.11	4.37
1978	334	1.88	2.01	2.29	2.55	3.04	4.29	2.39	7.60
1979	283	1.89	2.06	2.29	2.63	3.37	4.74	2.44	5.62
1980	155	1.84	1.99	2.50	3.06	3.71	4.64	2.62	4.35

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF THC CONCENTRATIONS (PPM)

EDMONTON : NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25_TH PERC	50_TH PERC	75_TH PERC	90_TH PERC	99_TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1974	81	1.97	2.15	3.00	3.62	5.14	12.29	3.25	12.29
1975	156	1.50	1.96	2.48	4.44	8.61	21.23	4.19	21.54
1976	602	1.77	1.96	2.08	2.31	2.70	6.51	2.25	15.06
1977	562	1.76	1.94	2.09	2.35	2.92	7.55	2.30	14.41
1978	687	1.71	1.94	2.14	2.50	3.52	28.25	2.94	51.59
1979	623	1.25	1.50	1.88	2.48	3.15	8.52	2.28	45.62
1980	482	1.50	1.65	1.93	2.24	2.66	7.80	2.11	11.23
1981	351	1.69	1.87	2.13	2.40	2.71	3.71	2.19	4.15
1982	312	1.70	1.90	2.08	2.32	2.79	4.91	2.20	5.73

SEIA TREND ANALYSIS
NUMBER OF STATIONS, DATA RECOVERY AND MAXIMUM DAILY AND HOURLY MEAN THC CONCENTRATIONS
EDMONTON; ALL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)
1974	1	22.5	12.29	92.00
1975	1	49.2	22.00	98.00
1976	3	83.5	15.08	40.00
1977	3	93.0	14.41	49.90
1978	3	94.9	51.59	88.80
1979	3	84.7	49.92	99.80
1980	3	59.2	11.23	49.90
1981	1	85.1	4.15	14.00
1982	1	85.1	5.73	7.70

SEIA TREND ANALYSIS
NUMBER OF STATIONS, DATA RECOVERY AND MAXIMUM DAILY AND HOURLY MEAN THC CONCENTRATIONS
EDMONTON: RESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)
1976	1	63.5	4.33	7.60
1977	1	92.8	4.37	9.90
1978	1	92.7	7.80	99.80
1979	1	79.7	5.82	19.80
1980	1	44.1	4.96	8.00

SEIA TREND ANALYSIS
NUMBER OF STATIONS, DATA RECOVERY AND MAXIMUM DAILY AND HOURLY MEAN THC CONCENTRATIONS
EDMONTON: NONRESIDENTIAL STATIONS

YEAR	NO. OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (PPM)	MAX HRLY VALUE (PPM)
1974	1	22.5	12.29	92.00
1975	1	46.2	22.00	99.00
1976	2	63.5	15.08	40.00
1977	2	78.1	14.41	49.90
1978	2	85.5	51.59	99.80
1979	2	87.2	49.92	98.80
1980	2	69.8	11.23	49.80
1981	1	95.1	4.15	14.00
1982	1	85.1	5.73	7.70

E5.1

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR TSP
EDMONTON: ALL STATIONS

MEANS (UG/M3)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1970	68.5	44.7	43.0	103.8	63.9	89.6	73.1	83.9	61.8	64.5	45.1	47.8	65.6	74.0
1971	37.9	40.7	37.9	88.9	108.0	45.2	57.7	62.0	26.3	49.2	45.0	20.7	47.4	82.2
1972	23.0	31.9	56.8	83.2	85.1	52.3	58.2	64.4	51.7	53.7	34.9	35.0	49.1	80.3
1973	33.5	50.1	80.6	77.3	68.1	66.8	69.3	49.1	64.5	70.8	58.0	35.6	58.1	71.1
1974	27.9	43.1	33.6	71.5	59.3	92.7	72.4	46.2	61.9	97.3	88.9	46.4	57.7	95.3
1975	56.6	33.7	64.2	62.6	70.5	65.1	122.5	77.8	113.5	102.3	107.0	43.5	72.5	94.1
1976	43.4	68.7	69.0	122.5	119.3	57.2	76.5	79.7	132.3	72.8	117.8	35.1	74.6	73.4
1977	42.3	104.1	118.0	150.3	86.7	92.7	50.0	78.9	59.8	94.4	78.8	32.5	74.8	93.4
1978	23.3	32.2	67.5	54.8	94.5	88.8	60.6	66.1	60.7	111.0	58.8	38.6	57.1	86.5
1979	29.3	33.9	102.4	80.8	77.9	115.2	101.1	102.1	95.4	113.8	121.8	51.1	77.6	79.6
1980	53.7	54.9	65.6	131.0	131.9	78.2	96.2	95.5	72.4	141.6	92.7	46.2	82.8	73.0
1981	40.2	69.1	75.0	85.4	80.0	82.7	89.9	107.4	84.5	63.6	83.7	50.2	75.2	92.6

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR TSP
EDMONTON: RESIDENTIAL STATIONS

MEANS (UG/M3)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1975	45.8	38.9	74.1	67.4	67.5	57.9	94.1	54.4	88.3	59.3	66.4	42.1	61.3	100.3
1976	34.5	61.6	60.3	125.3	87.8	50.5	69.9	62.7	144.8	75.2	118.0	28.6	67.7	93.4
1977	34.6	92.7	103.4	118.1	87.7	87.3	41.7	57.6	55.3	90.1	94.0	34.6	68.2	100.3
1978	21.0	39.2	82.2	57.6	100.3	98.5	68.7	83.1	77.3	146.1	64.9	36.6	65.1	98.6
1979	31.6	32.4	123.2	90.7	83.9	103.1	100.1	98.8	96.7	111.4	128.2	52.7	81.4	95.3
1980	58.8	63.6	72.7	130.1	127.2	74.4	105.1	87.8	58.2	108.1	84.9	47.5	82.2	93.4
1981	45.4	64.4	71.6	62.5	74.0	70.7	60.5	101.4	63.4	47.6	68.3	49.2	64.1	95.3

E5.1 cont'd.

SUMMARY OF MONTHLY AND ANNUAL MEAN CONCENTRATIONS FOR TSP
EDMONTON: NONRESIDENTIAL STATIONS

MEANS (UG/M3)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL MEAN	% DATA RECOVERY
1970	68.5	44.7	43.0	103.8	63.9	89.6	73.1	83.9	61.8	64.5	45.1	47.8	65.6	74.0
1971	37.9	40.7	37.9	88.9	108.0	45.2	57.7	62.0	26.3	49.2	45.0	20.7	47.4	82.2
1972	23.0	31.9	56.8	83.2	85.1	52.3	58.2	64.4	51.7	53.7	34.9	35.0	49.1	80.3
1973	33.5	50.1	80.6	77.3	68.1	66.8	69.3	49.1	64.5	70.8	58.0	35.6	58.1	71.1
1974	27.9	43.1	33.6	71.5	59.3	92.7	72.4	46.2	61.9	97.3	88.9	46.4	57.7	95.3
1975	61.9	32.1	60.9	61.1	71.6	68.3	133.7	87.6	123.3	124.3	128.6	44.1	77.1	92.1
1976	46.6	71.4	72.4	121.6	127.3	59.8	78.8	86.3	127.4	71.1	117.8	37.1	77.2	68.4
1977	44.5	107.9	122.6	159.6	86.5	94.0	52.6	86.1	61.3	95.5	75.0	32.0	76.8	91.6
1978	24.0	30.6	64.0	53.9	92.5	85.5	58.1	61.8	57.5	102.9	57.1	39.2	54.9	83.4
1979	28.7	34.5	97.7	77.7	76.4	120.3	101.5	103.2	95.0	114.7	119.4	50.8	76.4	75.6
1980	51.9	52.0	61.9	131.4	134.6	80.1	92.8	99.6	79.8	162.1	96.8	45.7	83.0	66.1
1981	37.5	71.9	76.7	99.8	83.2	90.2	109.6	110.6	97.6	75.0	92.6	50.8	81.7	91.2

SEIA TREND ANALYSIS
PERCENTILE DISTRIBUTION OF TSP CONCENTRATIONS (UG/M3)

EDMONTON: ALL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1970	90	33	41	68	105	141	184	65.6	184.0
1971	100	19	29	48	78	123	184	47.4	184.0
1972	98	19	31	51	87	116	253	49.1	253.0
1973	173	25	40	63	88	114	239	58.1	268.0
1974	174	22	33	60	101	143	269	57.7	294.0
1975	229	31	47	70	111	175	352	72.5	374.0
1976	224	28	44	74	120	193	371	74.6	509.0
1977	284	31	46	77	124	165	303	74.8	337.0
1978	263	22	35	64	102	148	231	57.1	260.0
1979	242	27	48	89	128	181	318	77.6	358.0
1980	178	37	50	80	133	186	337	82.8	458.0
1981	169	33	51	78	109	150	258	75.2	297.0

PERCENTILE DISTRIBUTION OF TSP CONCENTRATIONS (UG/M3)

EDMONTON: RESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1975	61	35	44	60	87	126	167	61.3	167.0
1976	57	22	43	73	106	168	258	67.7	258.0
1977	61	30	44	70	114	156	256	68.2	256.0
1978	60	20	47	70	109	158	213	65.1	213.0
1979	58	34	51	97	131	181	232	81.4	232.0
1980	57	39	55	81	122	178	254	82.2	254.0
1981	58	32	48	63	86	118	172	64.1	172.0

E5.2 cont'd.

PERCENTILE DISTRIBUTION OF TSP CONCENTRATIONS (UG/M3)

EDMONTON: NONRESIDENTIAL STATIONS

YEAR	NO OF VALID DAYS	10-TH PERC	25-TH PERC	50-TH PERC	75-TH PERC	90-TH PERC	99-TH PERC	ANNUAL MEAN	MAX DAILY MEAN
1970	90	33	41	68	105	141	184	65.6	184.0
1971	100	19	29	48	78	123	184	47.4	184.0
1972	98	19	31	51	87	116	253	49.1	253.0
1973	173	25	40	63	88	114	239	58.1	268.0
1974	174	22	33	60	101	143	269	57.7	294.0
1975	168	30	50	74	125	183	363	77.1	374.0
1976	167	30	45	75	137	200	419	77.2	509.0
1977	223	31	47	82	128	169	312	76.8	337.0
1978	203	22	33	59	97	144	244	54.9	260.0
1979	184	26	47	89	128	181	343	76.4	358.0
1980	121	36	48	80	138	207	421	83.0	458.0
1981	111	34	55	92	128	166	290	81.7	297.0

SEIA TREND ANALYSIS
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR TSP

EDMONTON: ALL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (UG/M3)	NO. GREATER THAN TOL 24HR	NO. GREATER THAN ACC 24HR
1970	2	74.0	184.0	0	11
1971	2	82.2	184.0	0	10
1972	2	80.3	253.0	0	9
1973	4	71.1	268.0	0	16
1974	3	95.3	294.0	0	28
1975	4	94.1	374.0	0	53
1976	5	73.4	509.0	1	56
1977	5	93.4	337.0	0	78
1978	5	86.5	260.0	0	45
1979	5	79.6	358.0	0	68
1980	4	73.0	458.0	1	54
1981	3	92.6	297.0	0	37

SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR TSP

EDMONTON: RESIDENTIAL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (UG/M3)	NO. GREATER THAN TOL 24HR	NO. GREATER THAN ACC 24HR
1975	1	100	167.0	0	8
1976	1	93.4	258.0	0	8
1977	1	100	256.0	0	13
1978	1	98.6	213.0	0	11
1979	1	95.3	232.0	0	17
1980	1	93.4	254.0	0	15
1981	1	95.3	172.0	0	5

E5.3 cont'd.

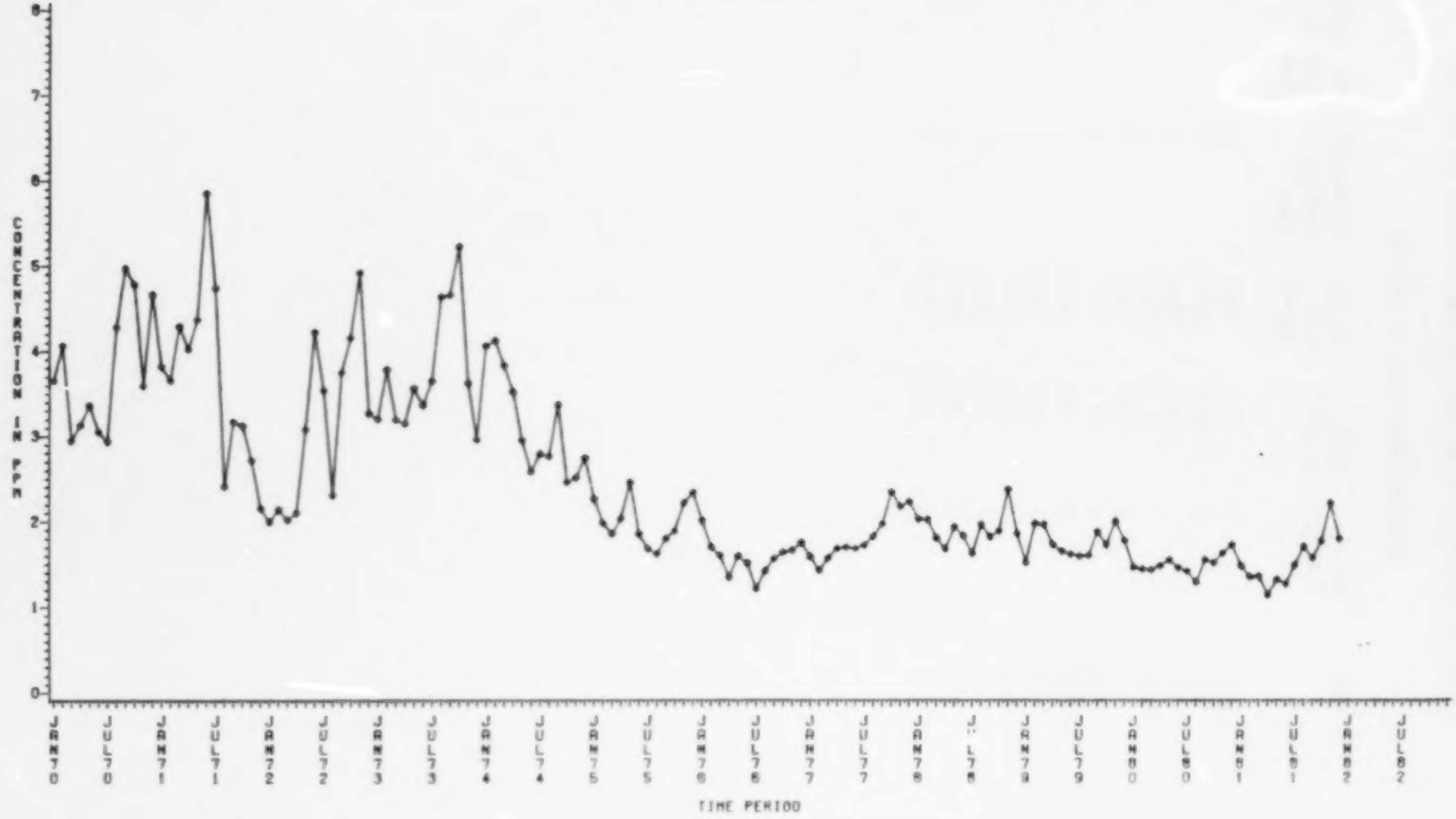
SUMMARY OF EXCEEDANCES OF NATIONAL AIR QUALITY OBJECTIVES FOR TSP

EDMONTON: NONRESIDENTIAL STATIONS

YEAR	NO.OF STATIONS	%DATA RECOVERY	MAX DLY MEAN (UG/M3)	NO.GREATER THAN TOL 24HR	NO. GREATER THAN ACC 24HR
1970	2	74.0	184.0	0	11
1971	2	82.2	184.0	0	10
1972	2	80.3	253.0	0	9
1973	4	71.1	268.0	0	16
1974	3	95.3	294.0	0	28
1975	3	92.1	374.0	0	45
1976	4	68.4	509.0	1	48
1977	4	91.6	337.0	0	65
1978	4	83.4	260.0	0	34
1979	4	75.6	358.0	0	51
1980	3	66.1	458.0	1	39
1981	2	91.2	297.0	0	32

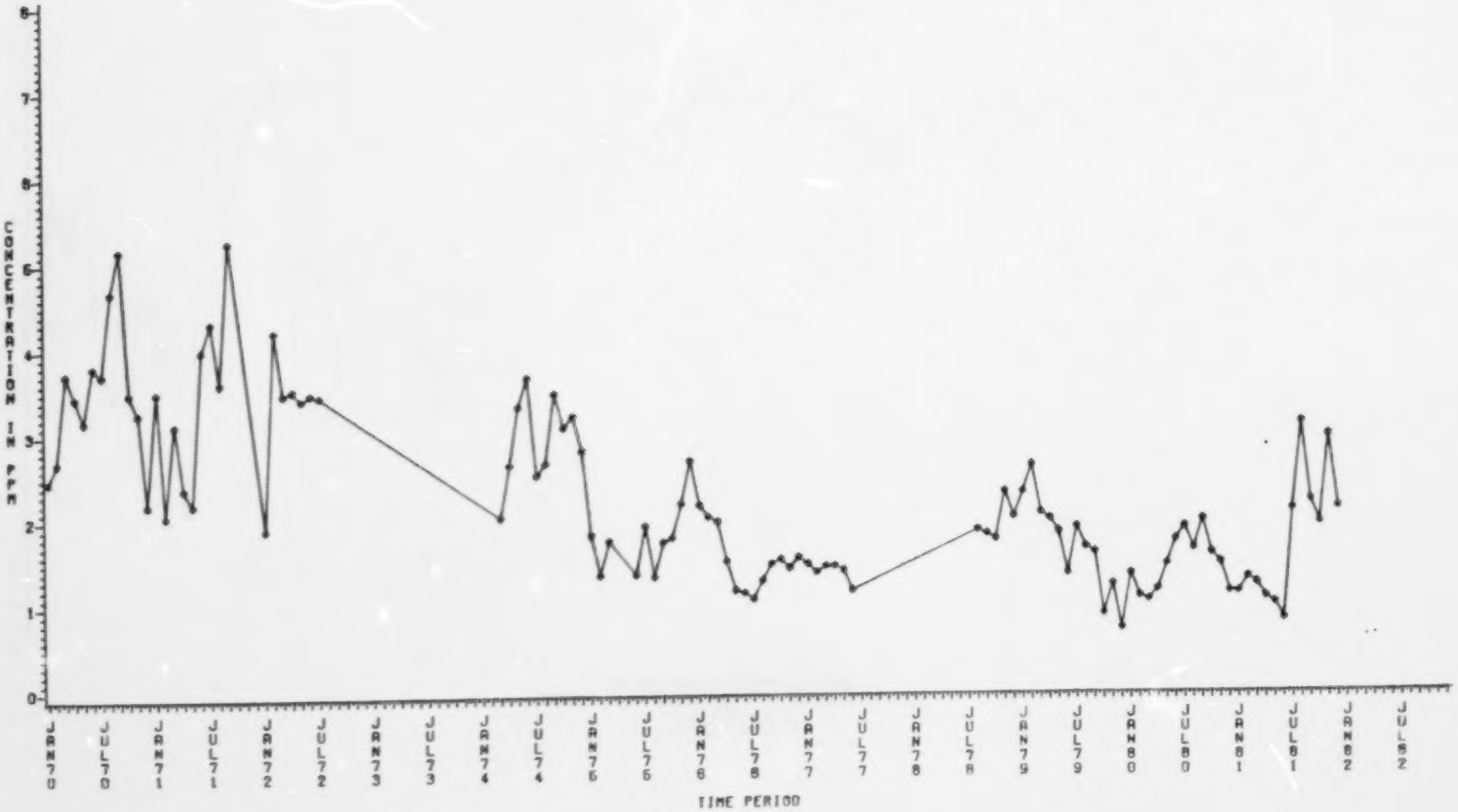
TORONTO

**COMPOSITE MONTHLY MEAN CO CONCENTRATIONS
FOR ALL STATIONS**



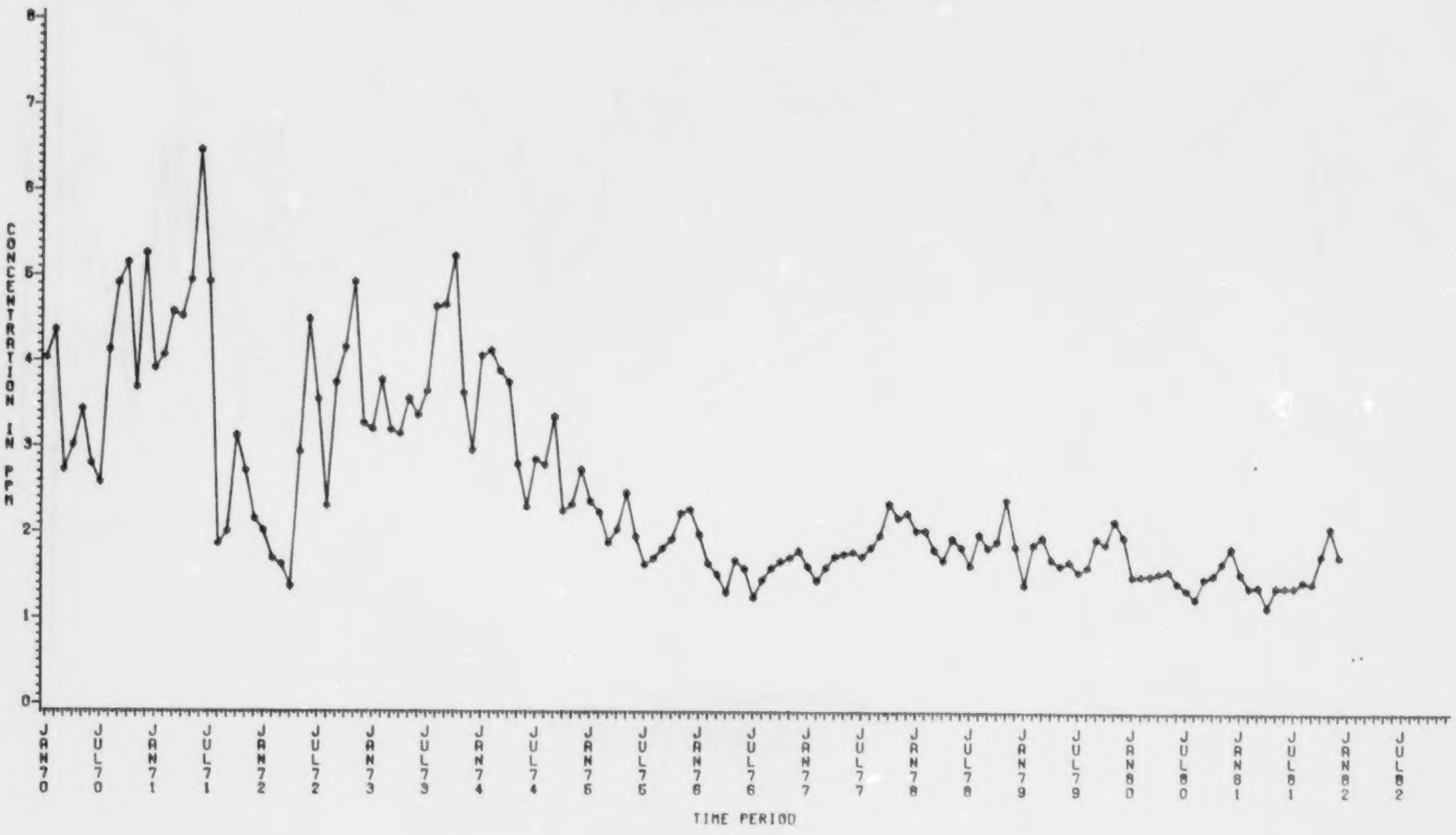
TORONTO

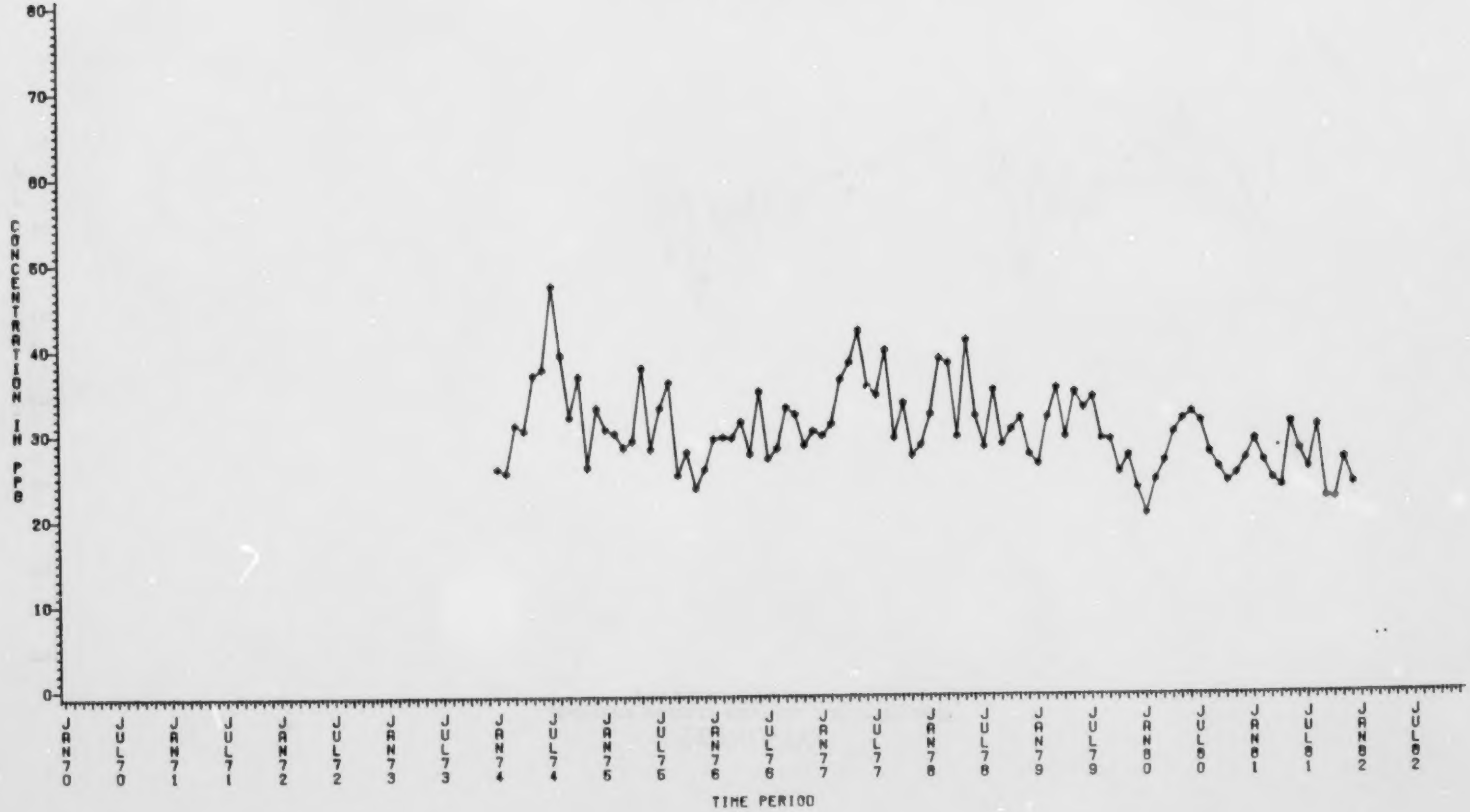
COMPOSITE MONTHLY MEAN CO CONCENTRATIONS FOR RESIDENTIAL STATIONS



TORONTO

COMPOSITE MONTHLY MEAN CO CONCENTRATIONS FOR NON-RESIDENTIAL STATIONS



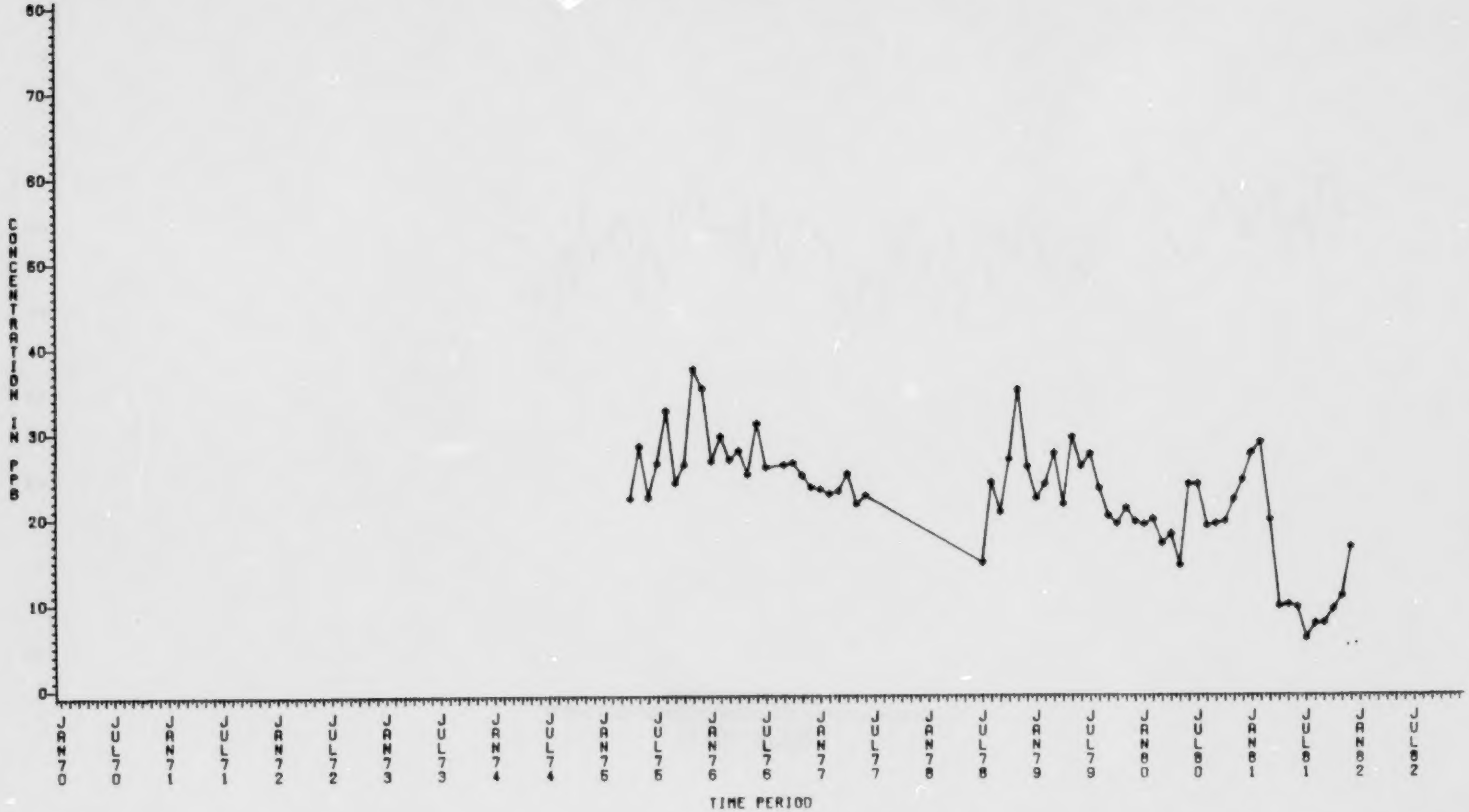


TORONTO

COMPOSITE MONTHLY MEAN NOX CONCENTRATIONS
FOR ALL STATIONS

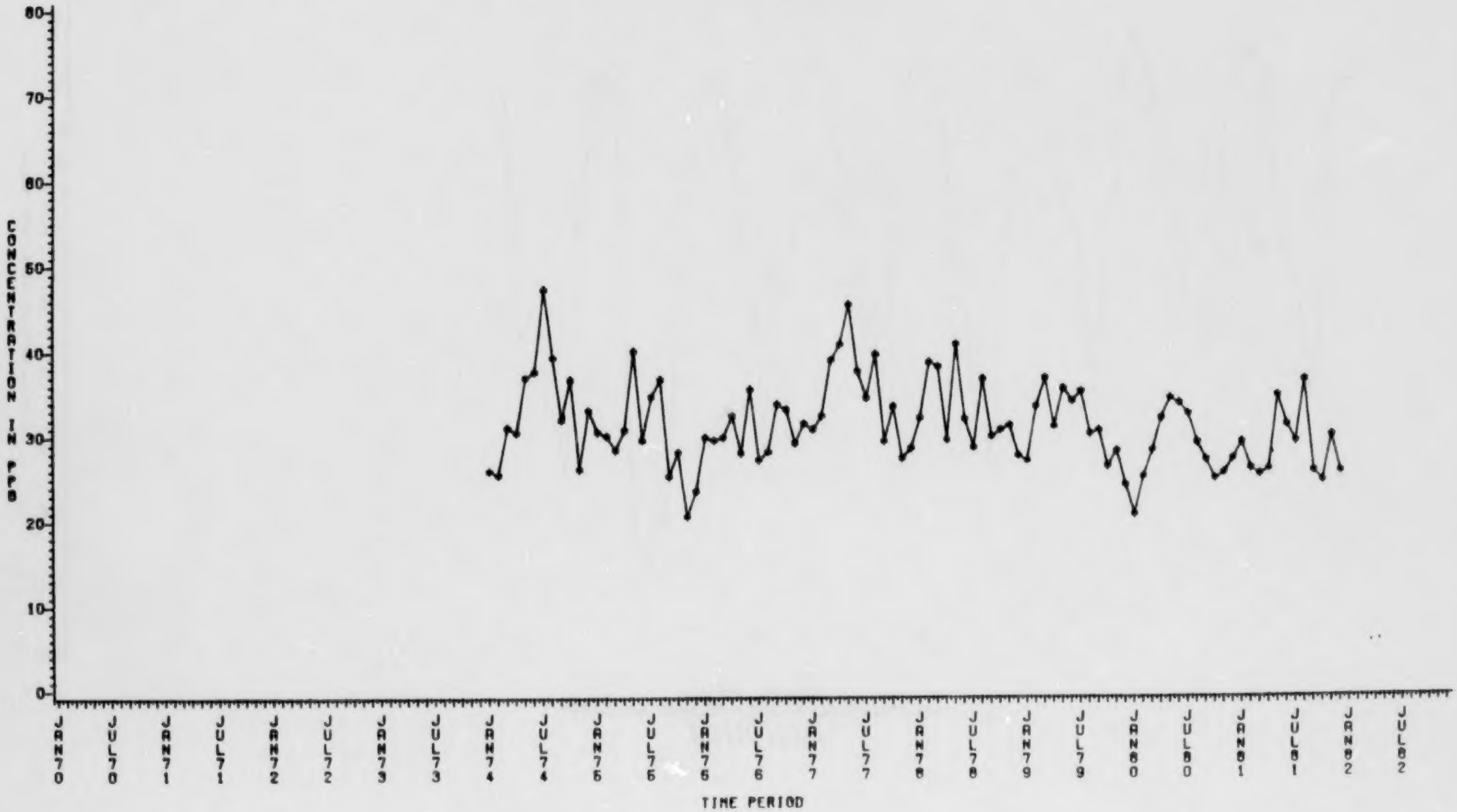
TORONTO

COMPOSITE MONTHLY MEAN NO2 CONCENTRATIONS FOR RESIDENTIAL STATIONS



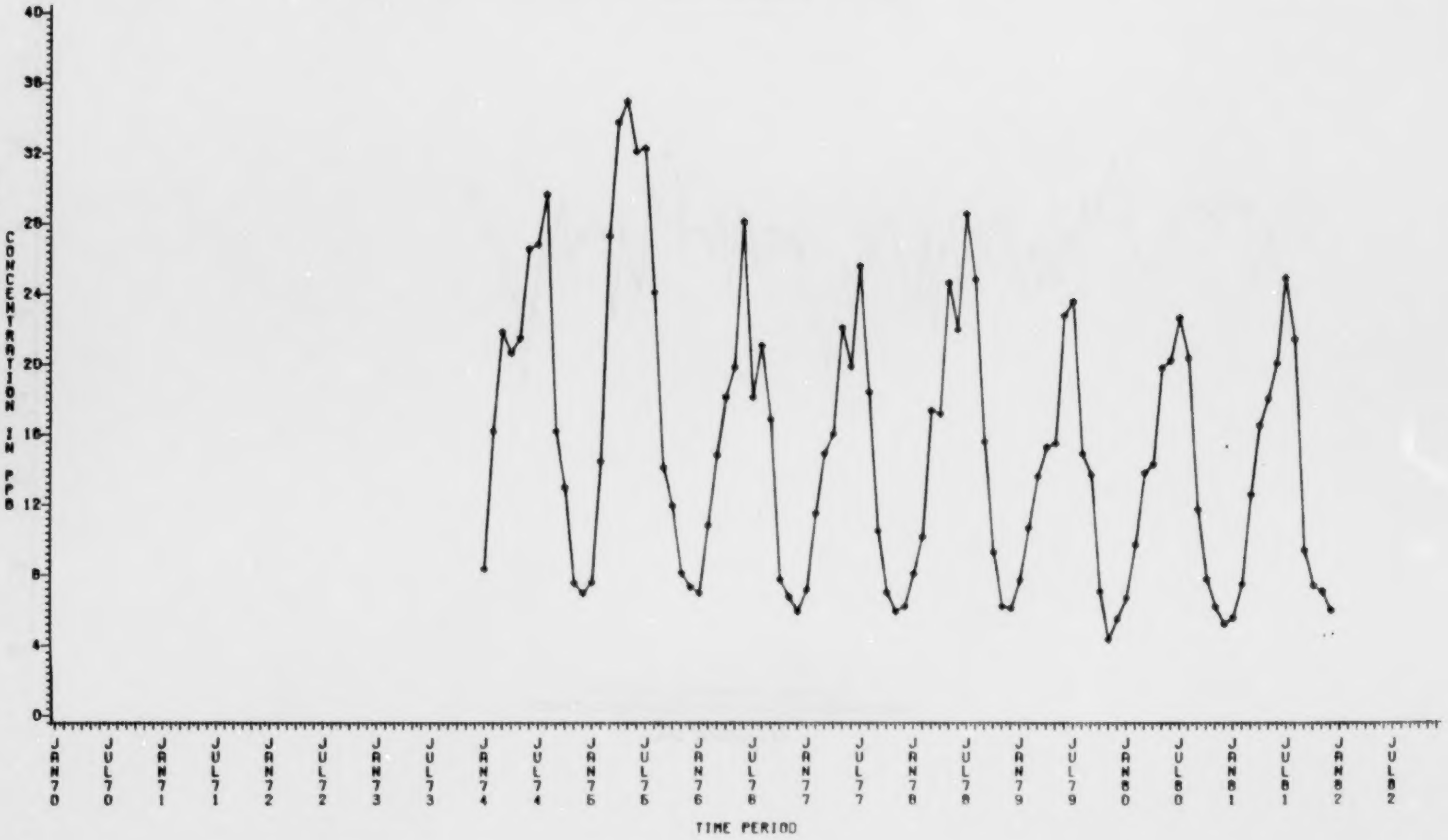
TORONTO

COMPOSITE MONTHLY MEAN NOX CONCENTRATIONS
FOR NON-RESIDENTIAL STATIONS



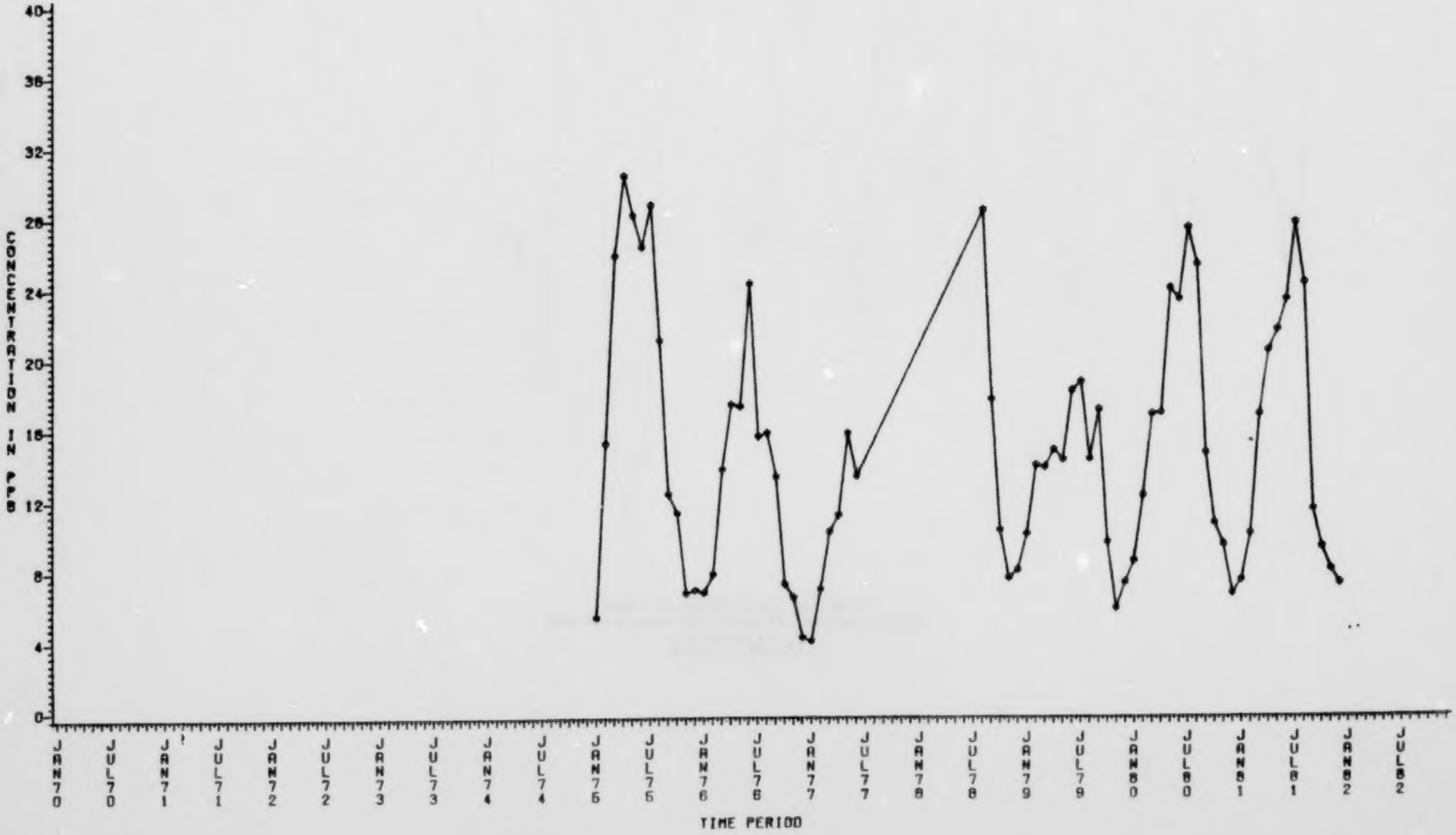
TORONTO

COMPOSITE MONTHLY MEAN O3 CONCENTRATIONS
FOR ALL STATIONS



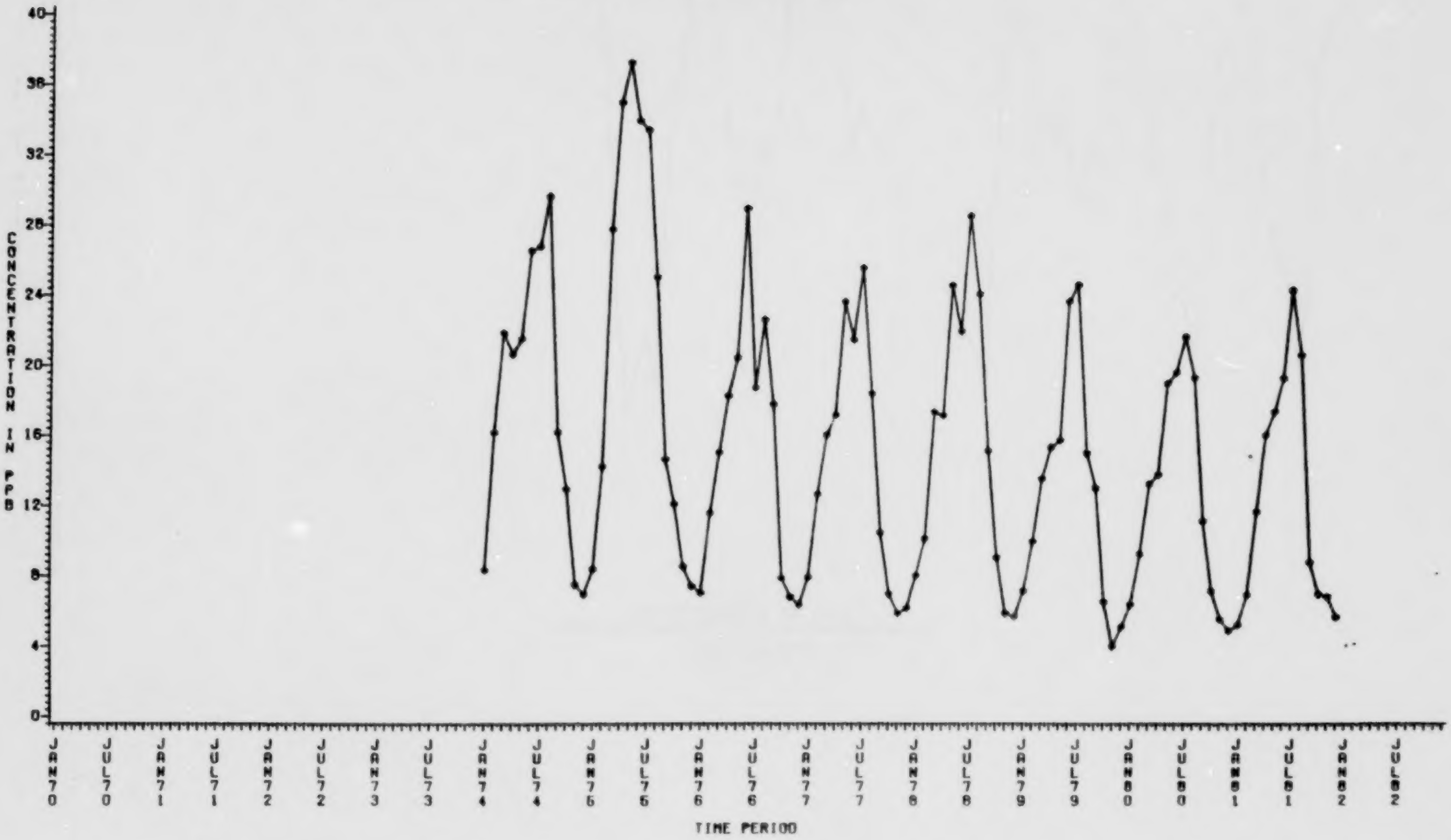
TORONTO

COMPOSITE MONTHLY MEAN O3 CONCENTRATIONS
FOR RESIDENTIAL STATIONS



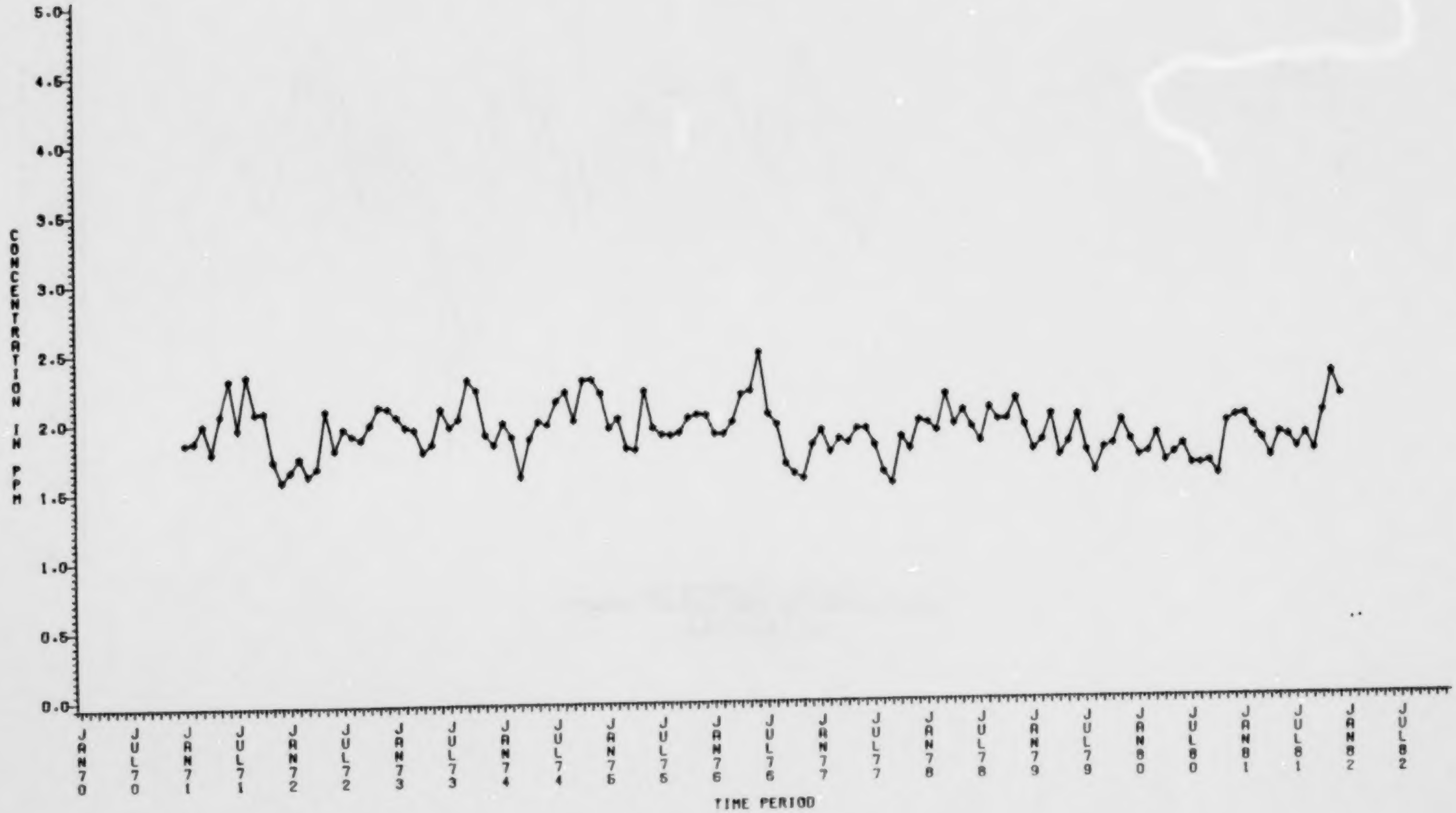
TORONTO

COMPOSITE MONTHLY MEAN O3 CONCENTRATIONS FOR NON-RESIDENTIAL STATIONS



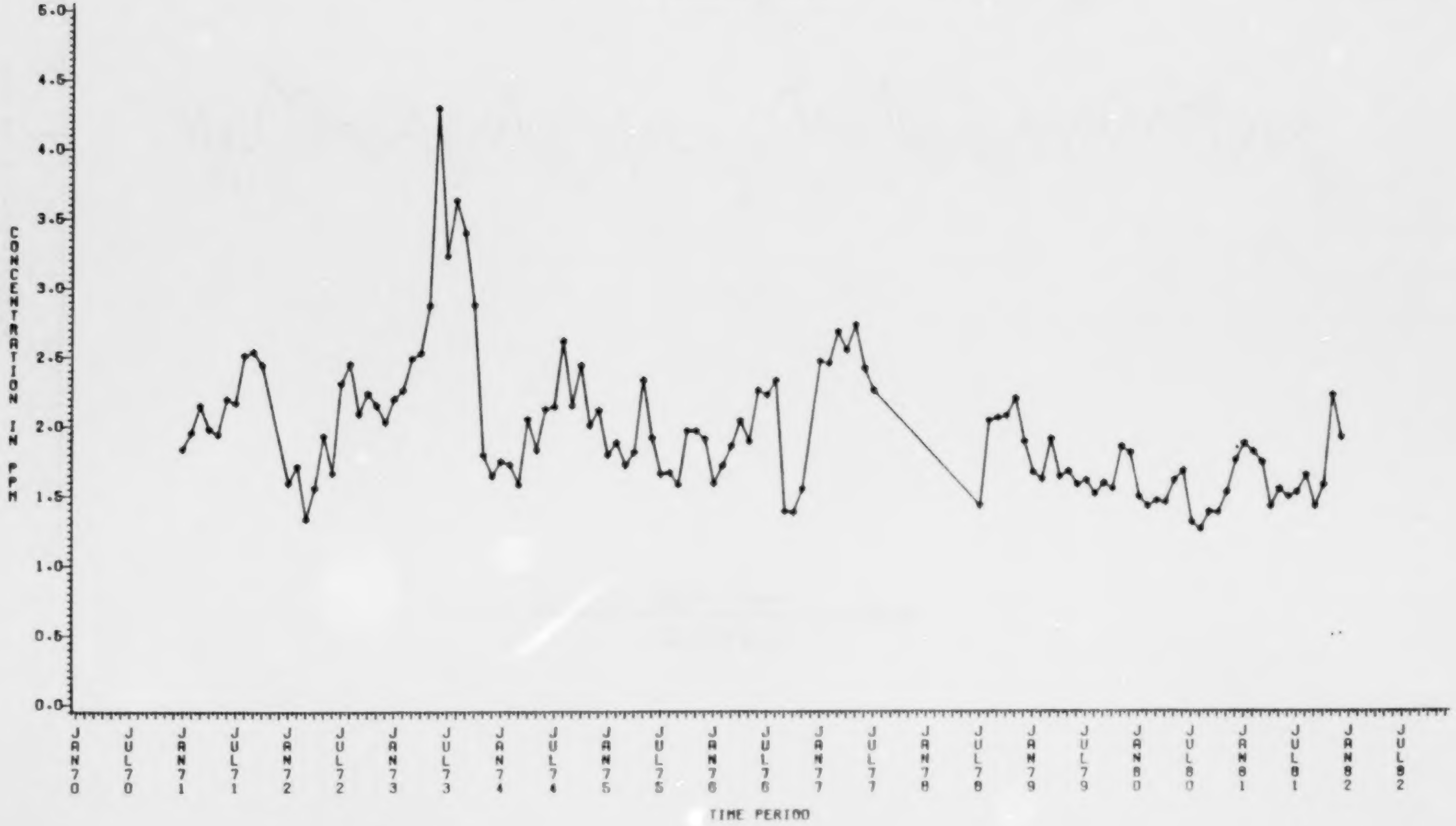
TORONTO

COMPOSITE MONTHLY MEAN THC CONCENTRATIONS
FOR ALL STATIONS



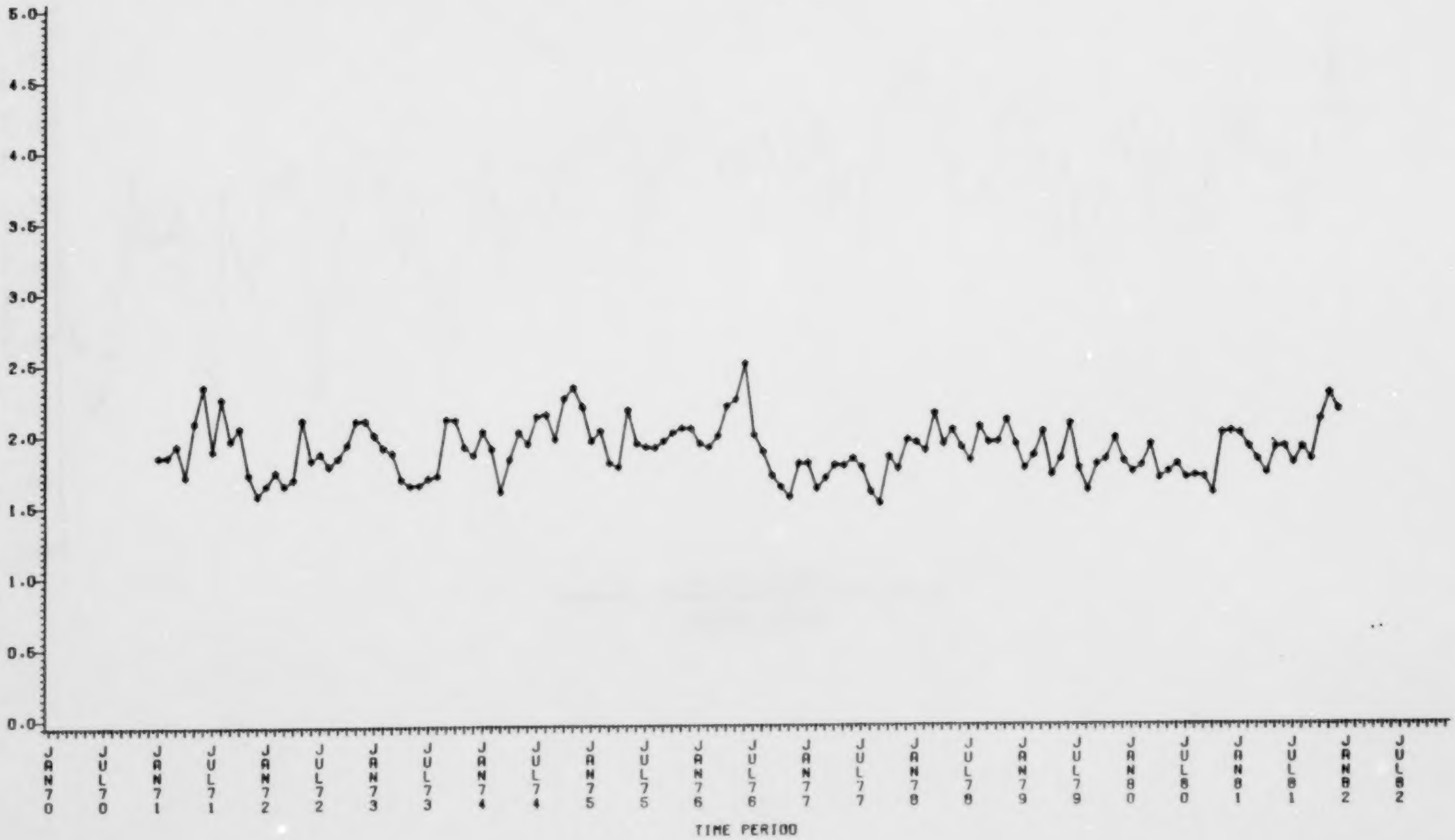
TORONTO

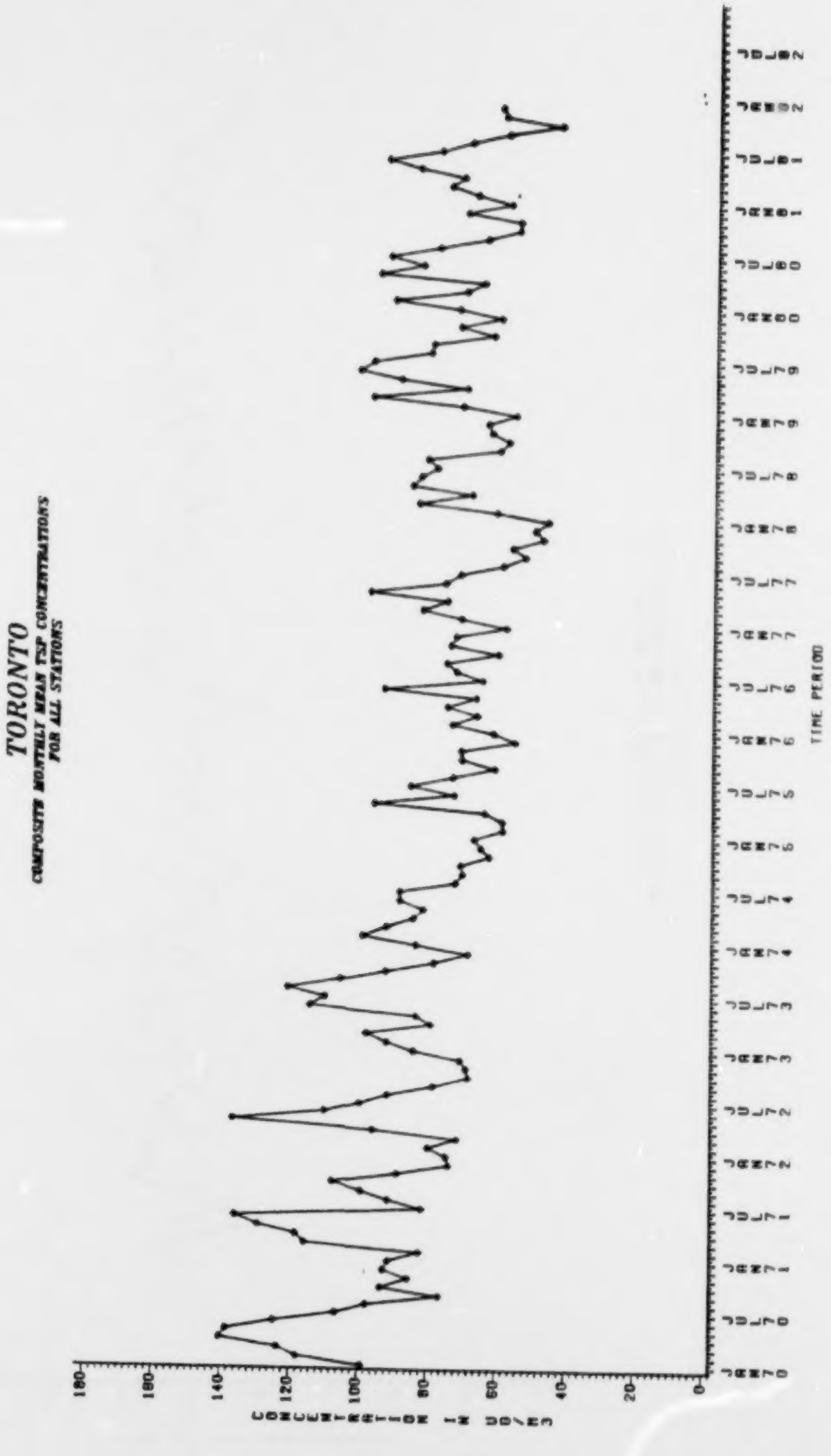
COMPOSITE MONTHLY MEAN THC CONCENTRATIONS FOR RESIDENTIAL STATIONS



TORONTO

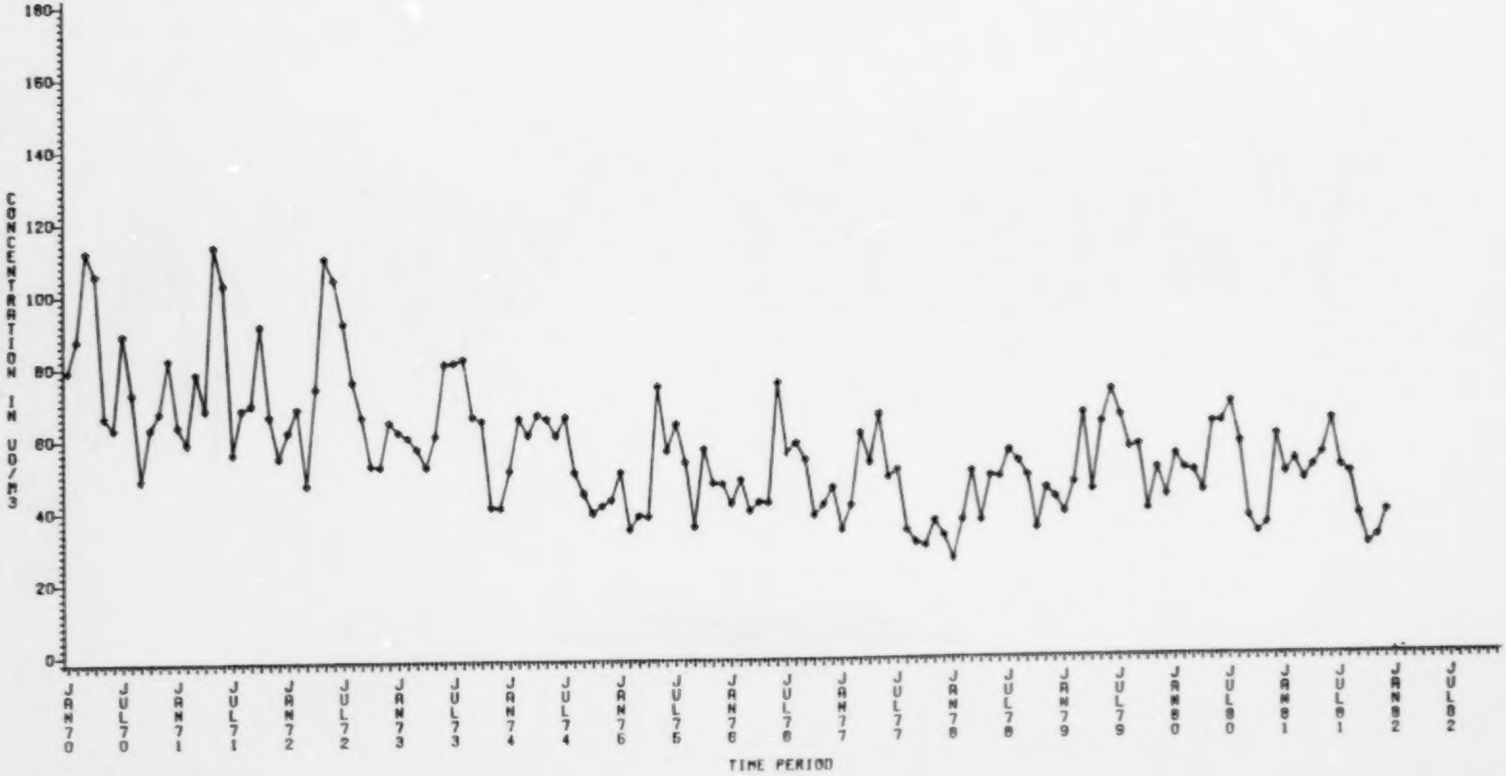
COMPOSITE MONTHLY MEAN THC CONCENTRATIONS FOR NON-RESIDENTIAL STATIONS

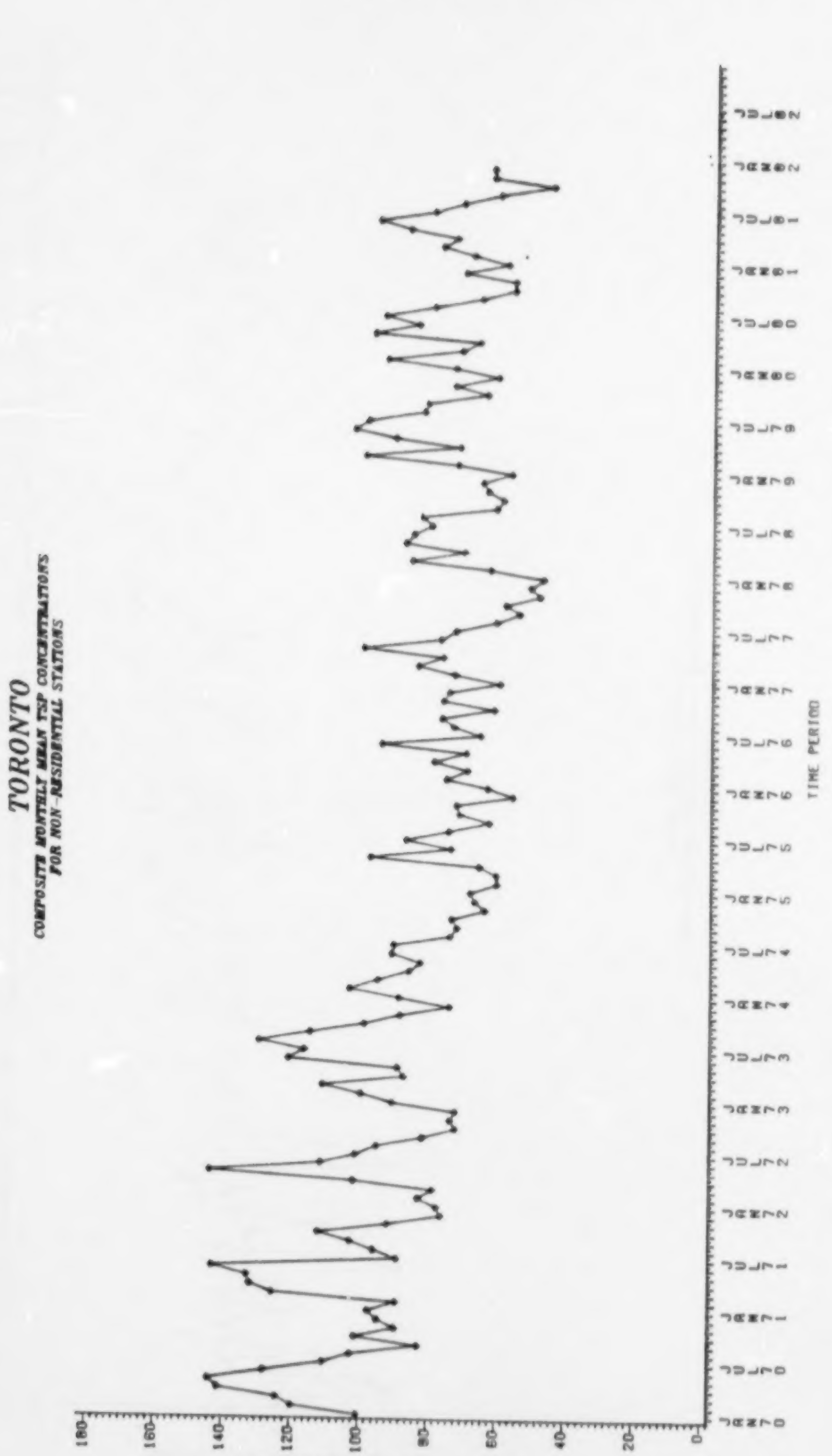



TORONTO
COMPOSITE MONTHLY MEAN TSP CONCENTRATIONS FOR ALL STATIONS
CONCENTRATION IN UG/M3
180
160
140
120
100
80
60
40
20
0
TIME PERIOD
JAN70
JUL70
JAN71
JUL71
JAN72
JUL72
JAN73
JUL73
JAN74
JUL74
JAN75
JUL75
JAN76
JUL76
JAN77
JUL77
JAN78
JUL78
JAN79
JUL79
JAN80
JUL80
JAN81
JUL81
JAN82
JUL82

TORONTO

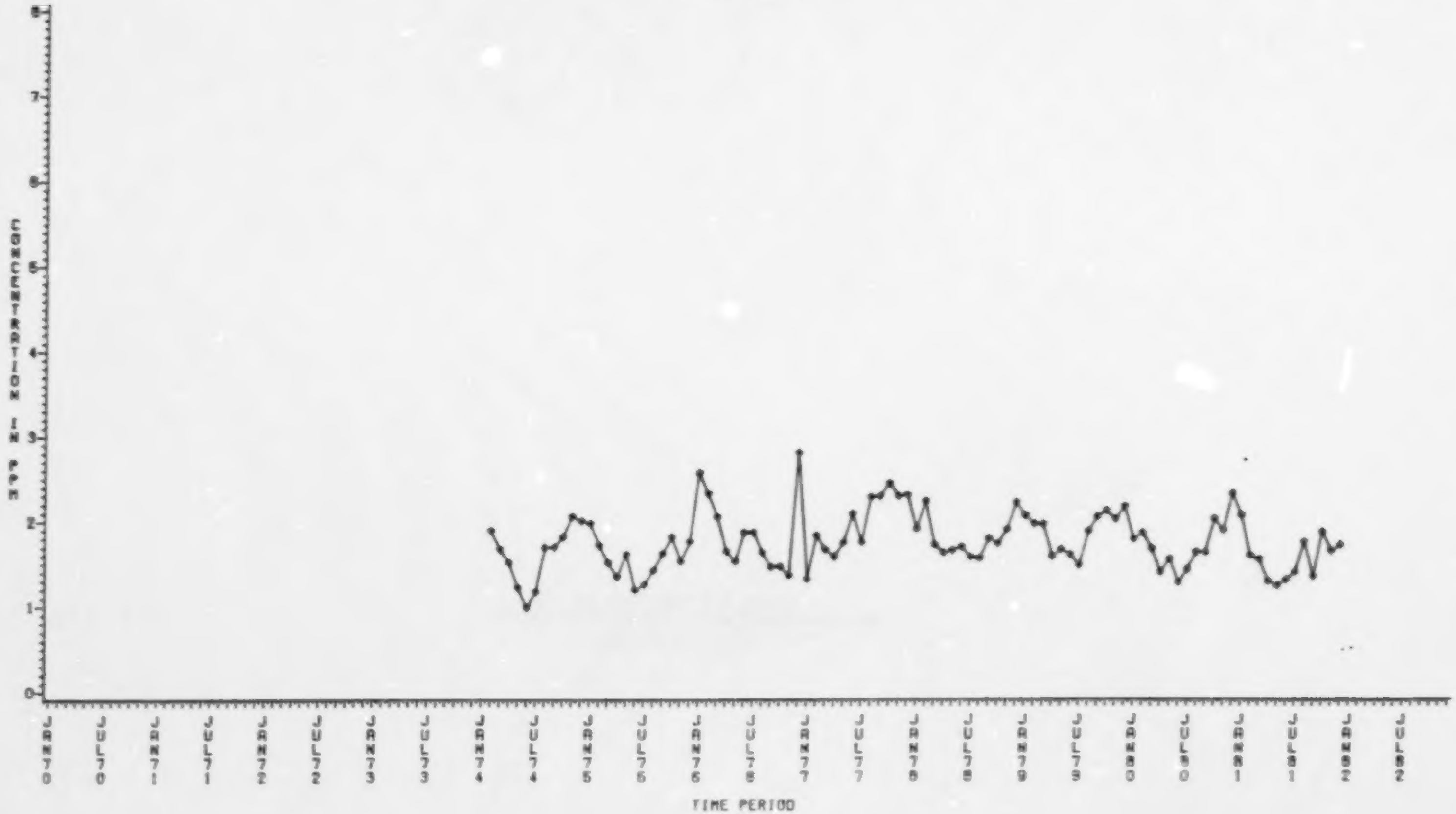
COMPOSITE MONTHLY MEAN TSP CONCENTRATIONS FOR RESIDENTIAL STATIONS




TORONTO
COMPOSITE MONTHLY MEAN TSP CONCENTRATIONS
FOR NON-RESIDENTIAL STATIONS
CONCENTRATION IN UG/M3
180
160
140
120
100
80
60
40
20
0
JAN70
JUL70
JAN71
JUL71
JAN72
JUL72
JAN73
JUL73
JAN74
JUL74
JAN75
JUL75
JAN76
JUL76
JAN77
JUL77
JAN78
JUL78
JAN79
JUL79
JAN80
JUL80
JAN81
JUL81
JAN82
JUL82
TIME PERIOD

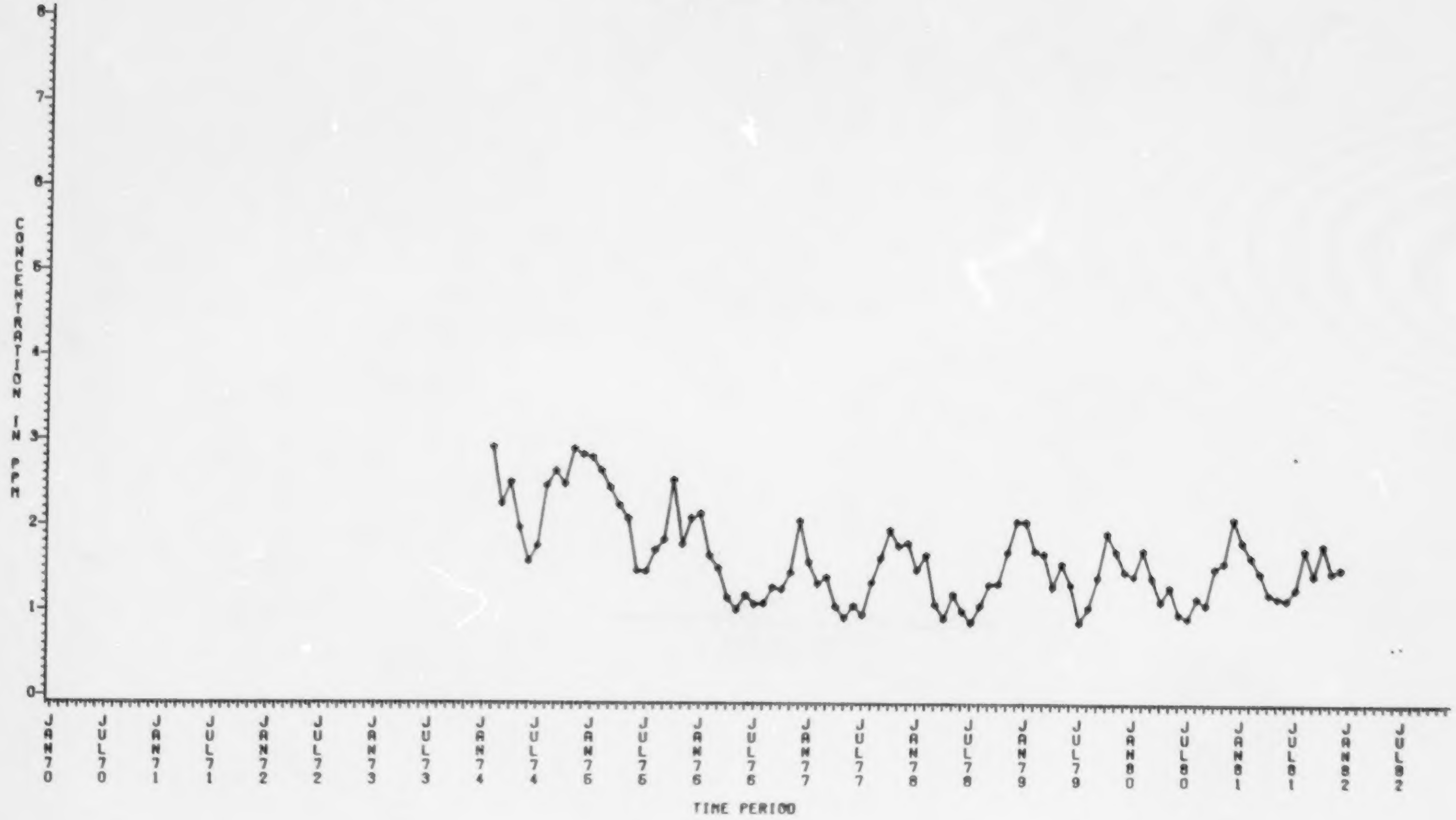
MONTREAL

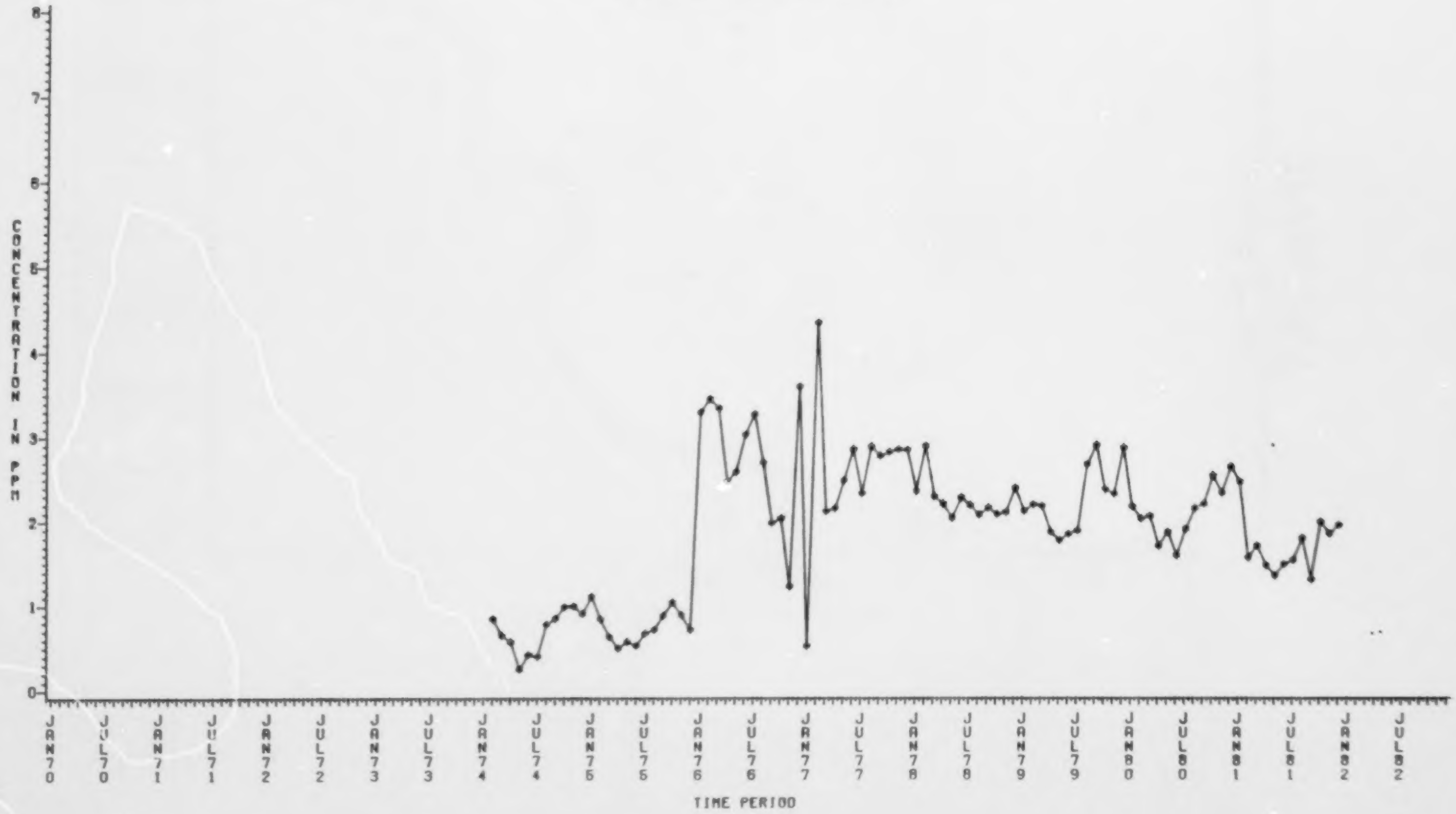
COMPOSITE MONTHLY MEAN CO CONCENTRATIONS
FOR ALL STATIONS



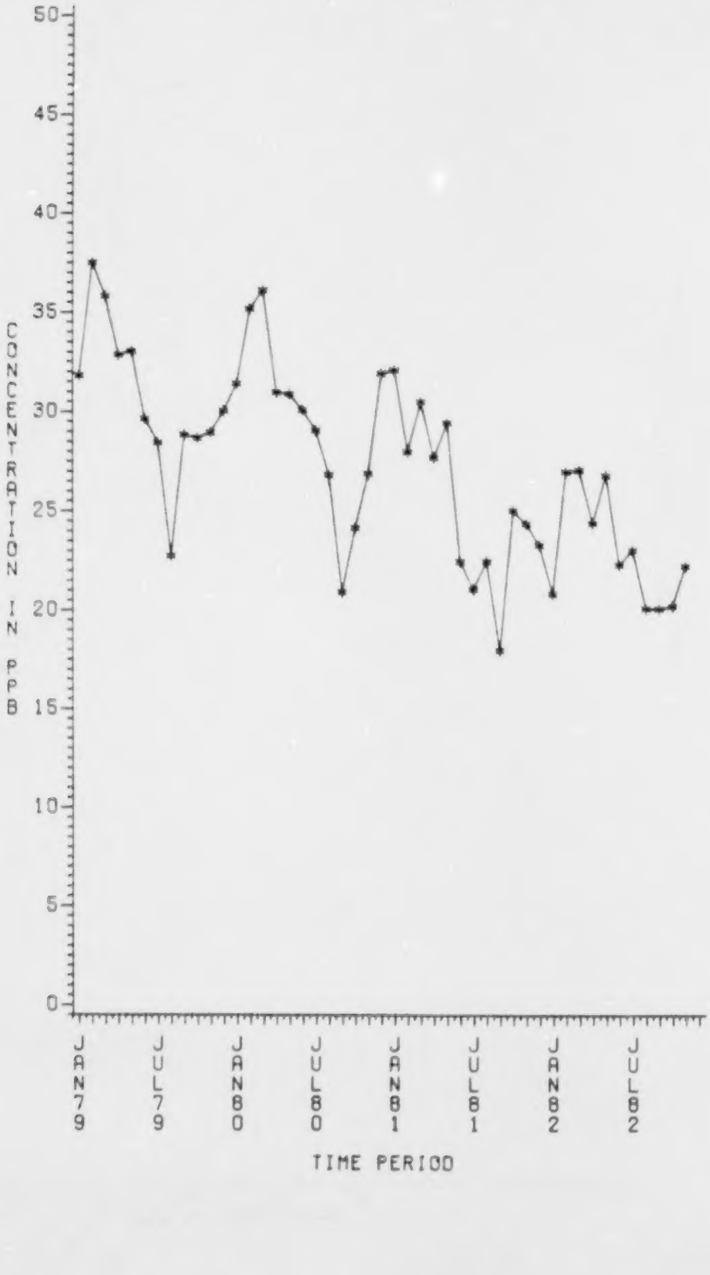
MONTREAL

COMPOSITE MONTHLY MEAN CO CONCENTRATIONS FOR RESIDENTIAL STATIONS





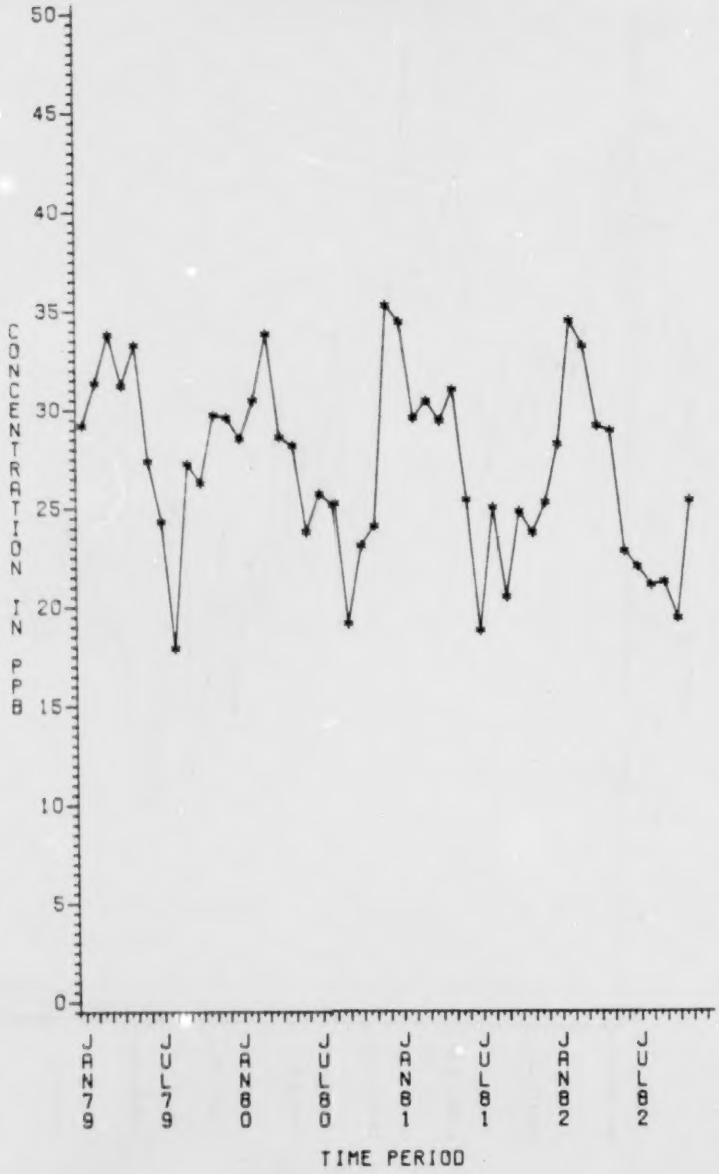
MONTREAL
COMPOSITE MONTHLY MEAN CO CONCENTRATIONS
FOR NON-RESIDENTIAL STATIONS



MONTREAL
COMPOSITE MONTHLY MEAN NO2 CONCENTRATIONS
FOR ALL STATIONS

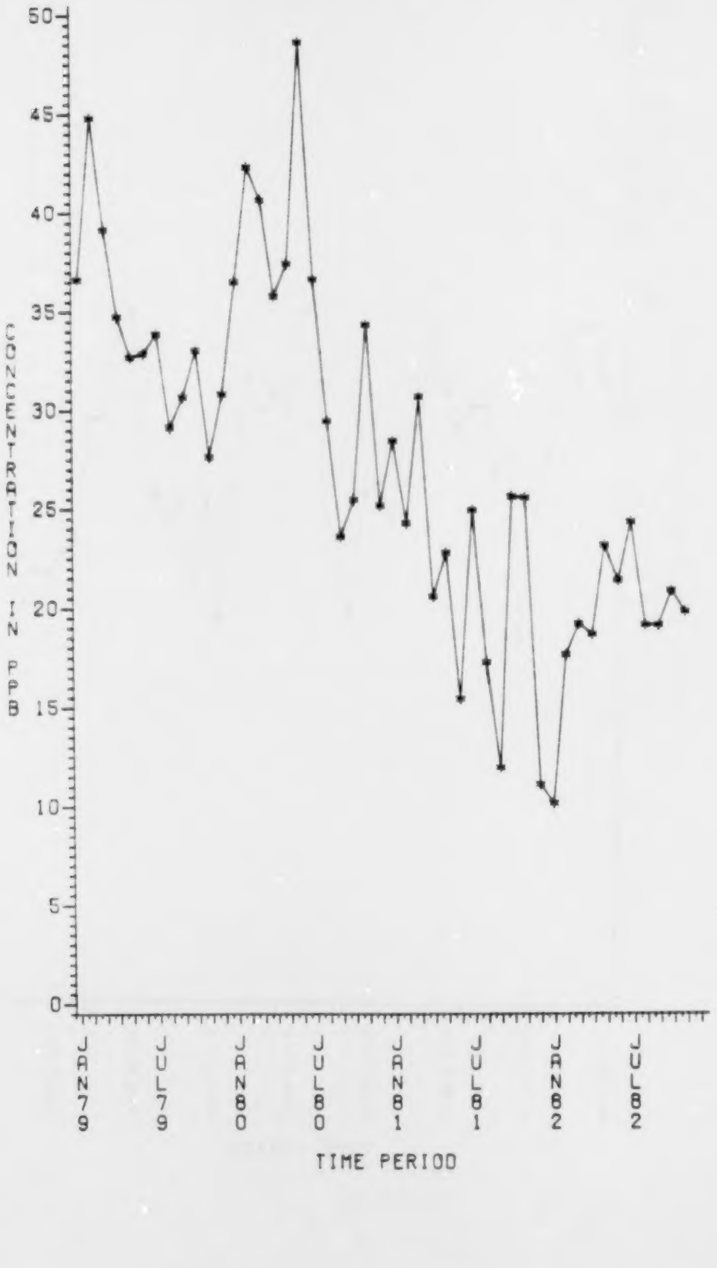
MONTREAL

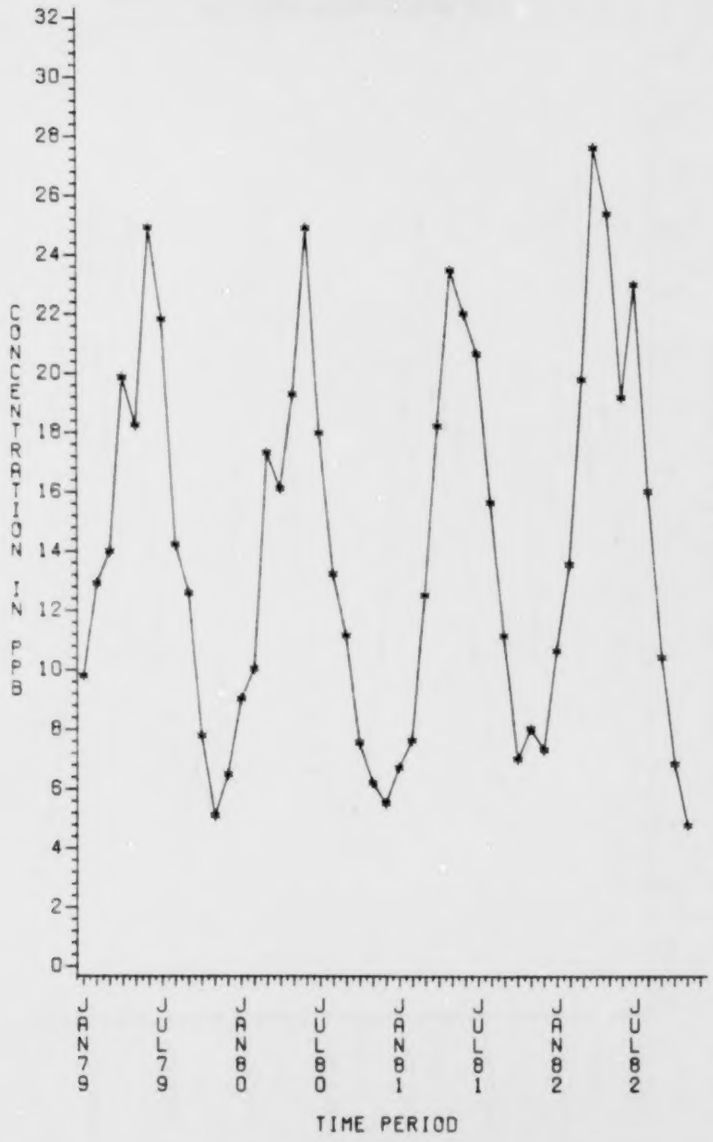
COMPOSITE MONTHLY MEAN NO2 CONCENTRATIONS FOR RESIDENTIAL STATIONS



MONTREAL

COMPOSITE MONTHLY MEAN NO2 CONCENTRATIONS FOR NON-RESIDENTIAL STATIONS



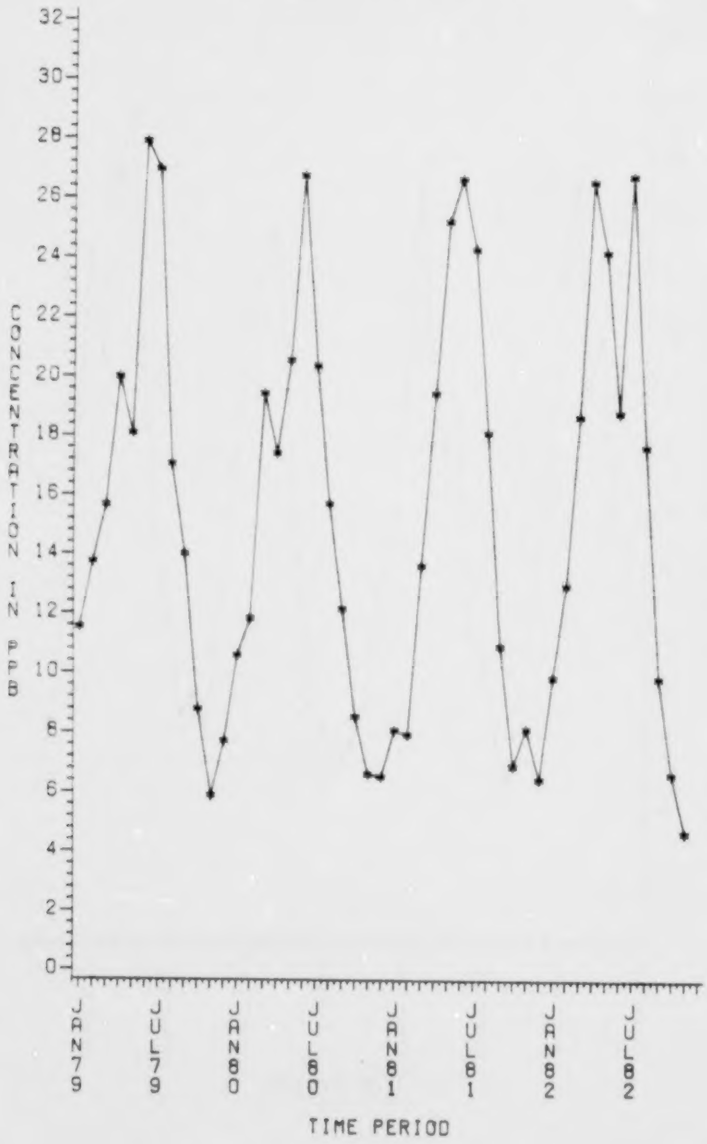


MONTREAL

COMPOSITE MONTHLY MEAN OZONE CONCENTRATIONS FOR ALL STATIONS

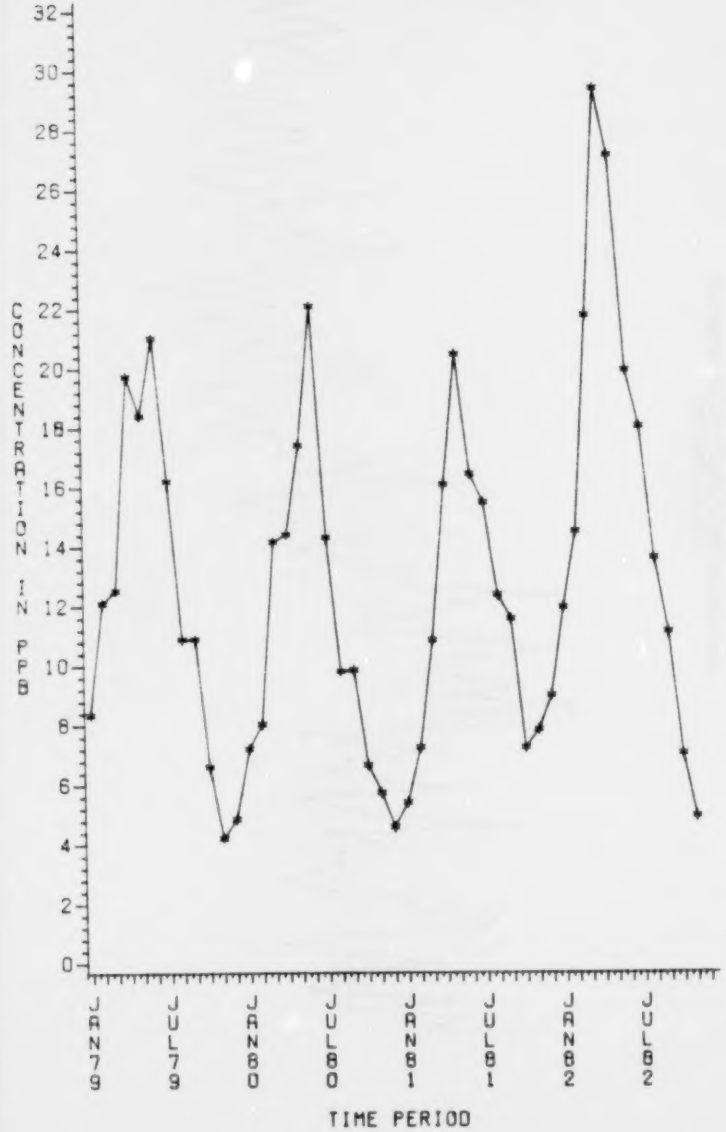
MONTREAL

COMPOSITE MONTHLY MEAN OZONE CONCENTRATIONS FOR RESIDENTIAL STATIONS



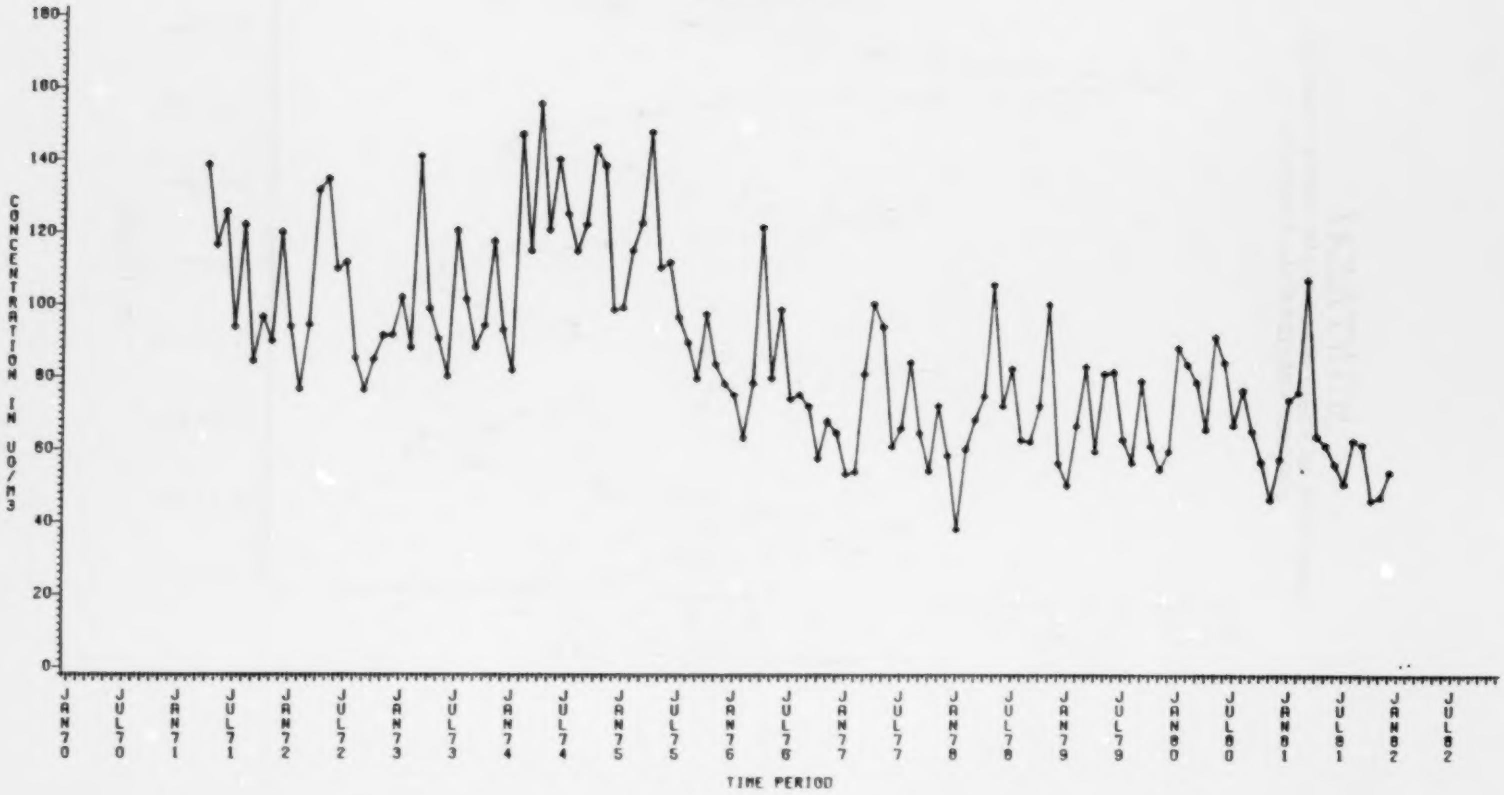
MONTREAL

COMPOSITE MONTHLY MEAN OZONE CONCENTRATIONS FOR NON-RESIDENTIAL STATIONS



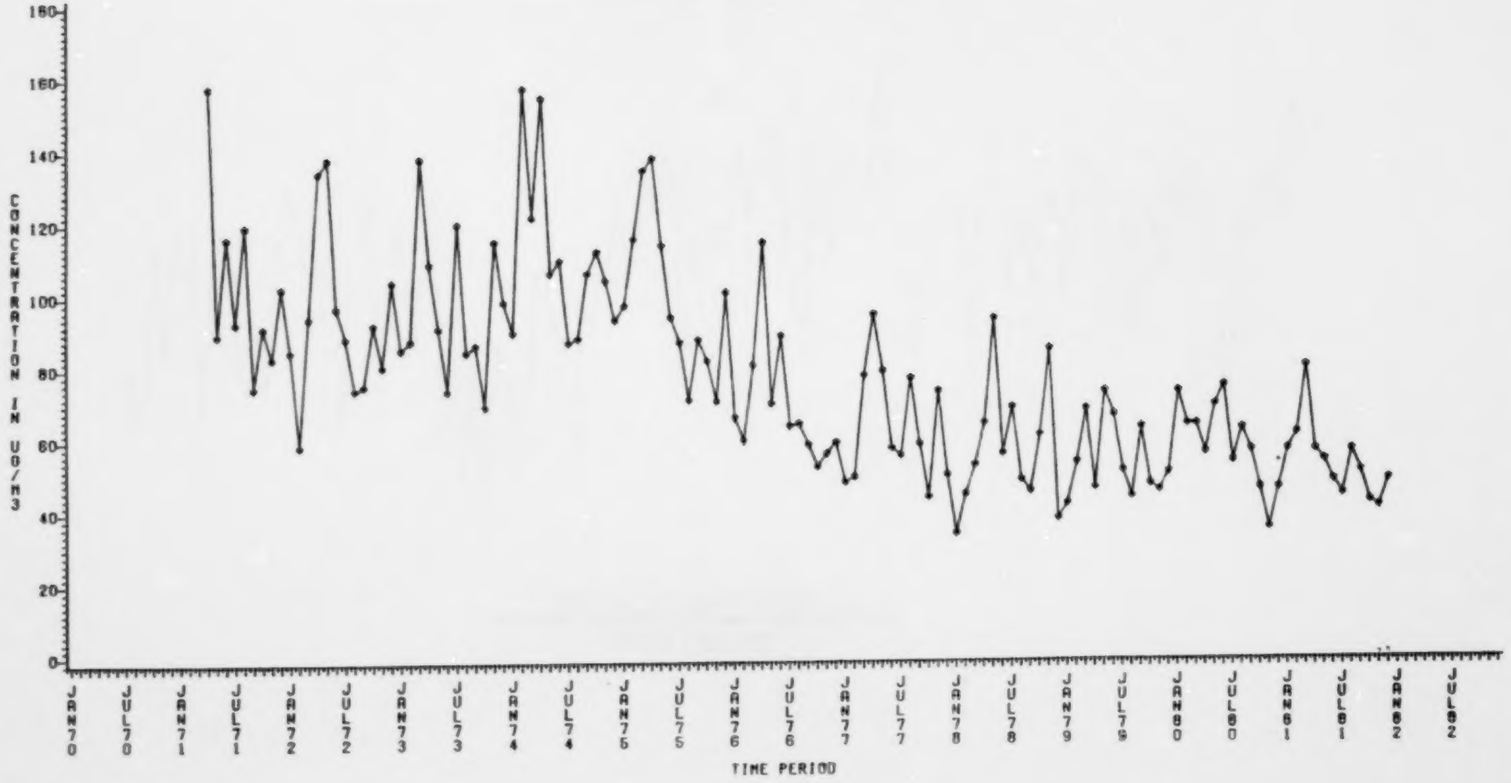
MONTREAL

COMPOSITE MONTHLY MEAN TSP CONCENTRATIONS FOR ALL STATIONS



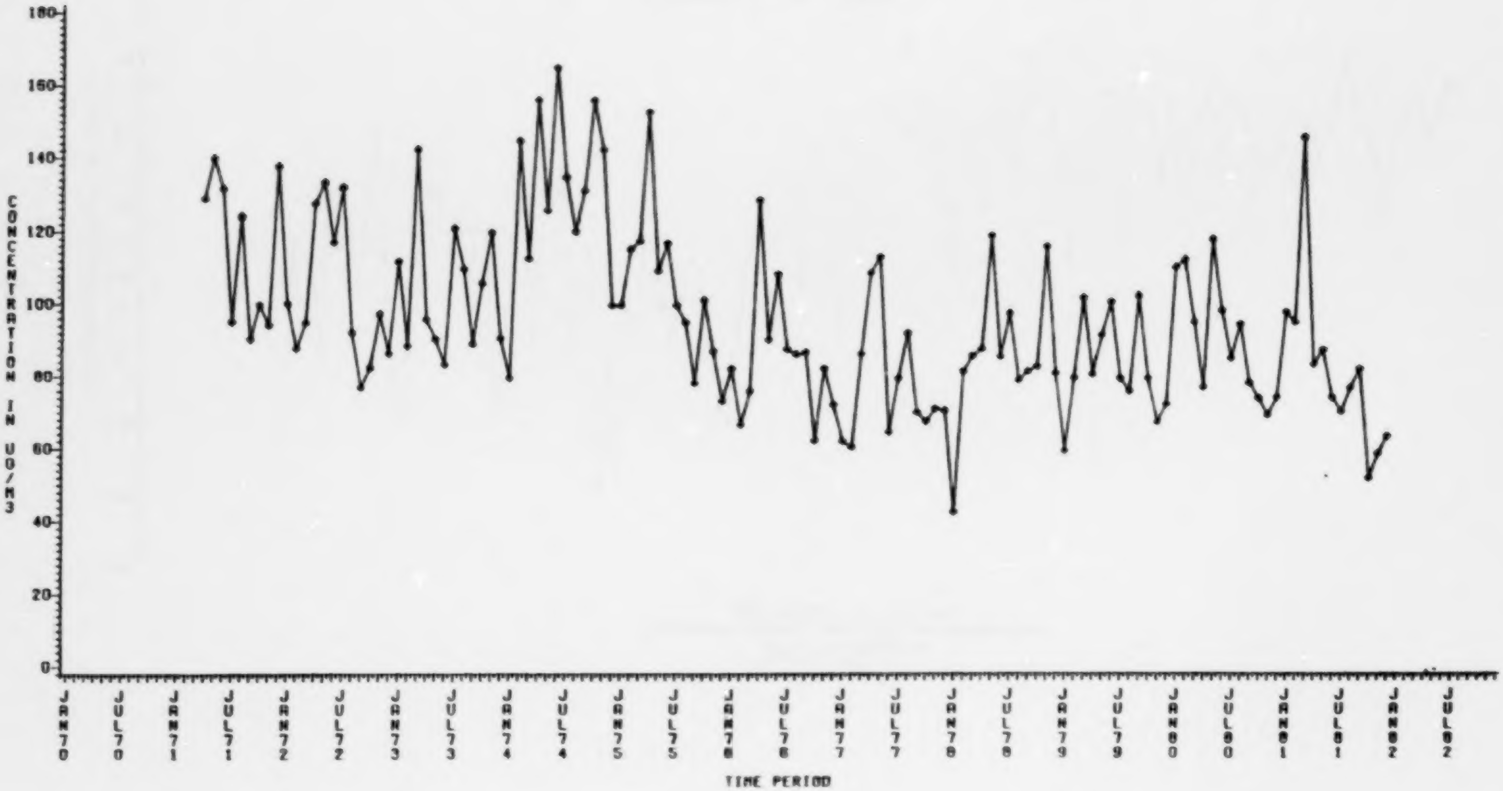
MONTREAL

COMPOSITE MONTHLY MEAN TSP CONCENTRATIONS FOR RESIDENTIAL STATIONS



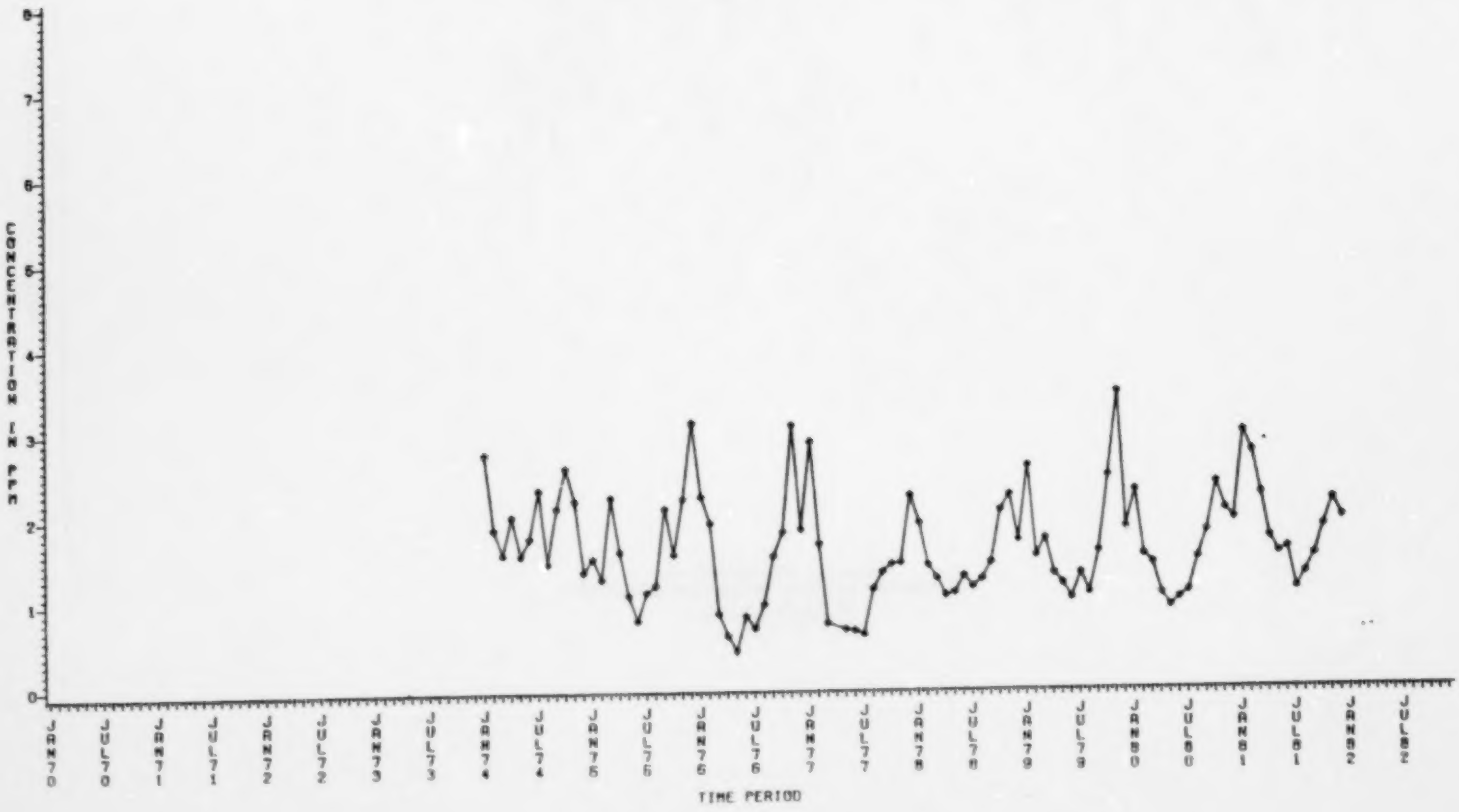
MONTREAL

COMPOSITE MONTHLY MEAN TSP CONCENTRATIONS FOR NON-RESIDENTIAL STATIONS



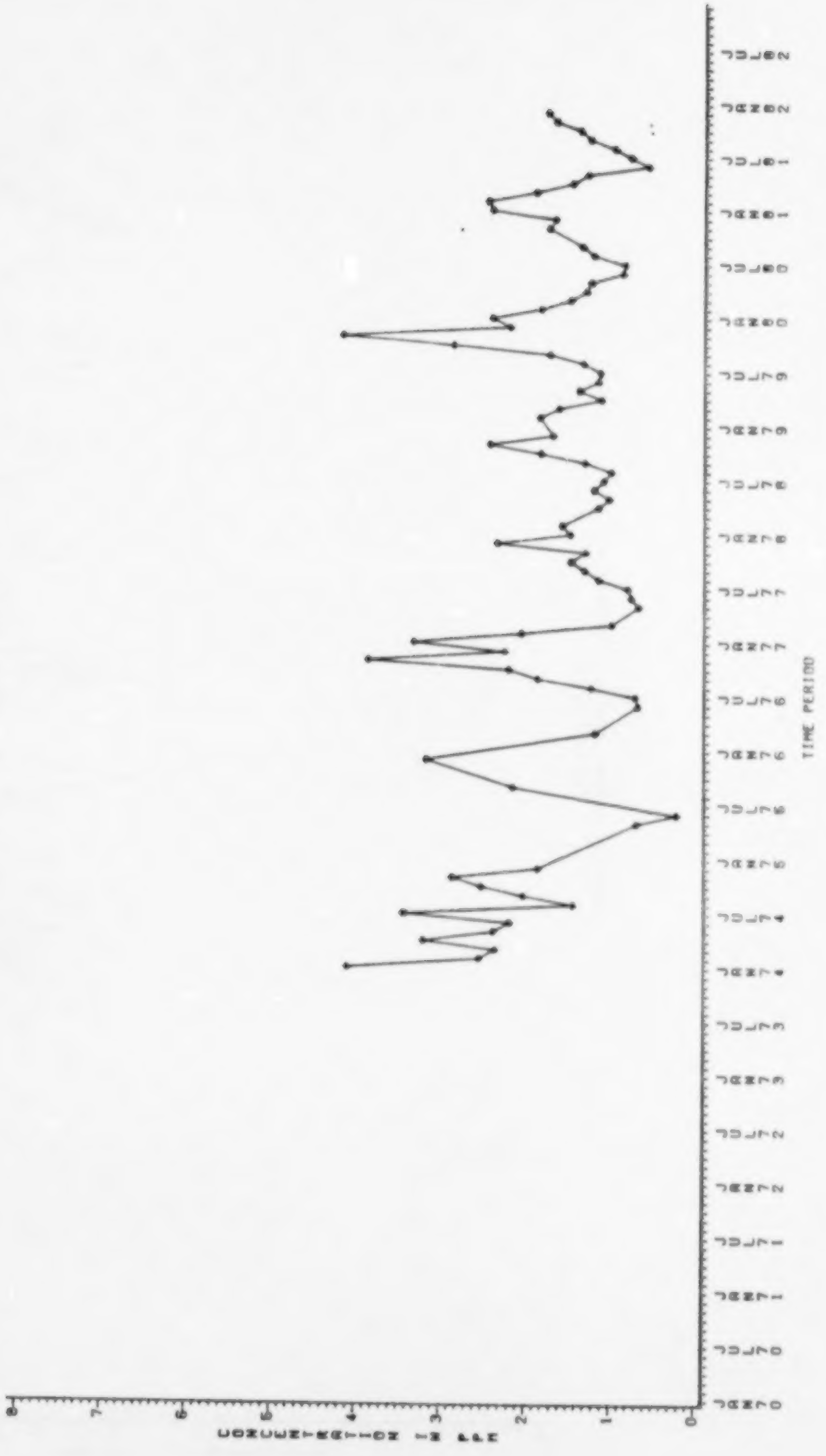
VANCOUVER

COMPOSITE MONTHLY MEAN CO CONCENTRATIONS FOR ALL STATIONS



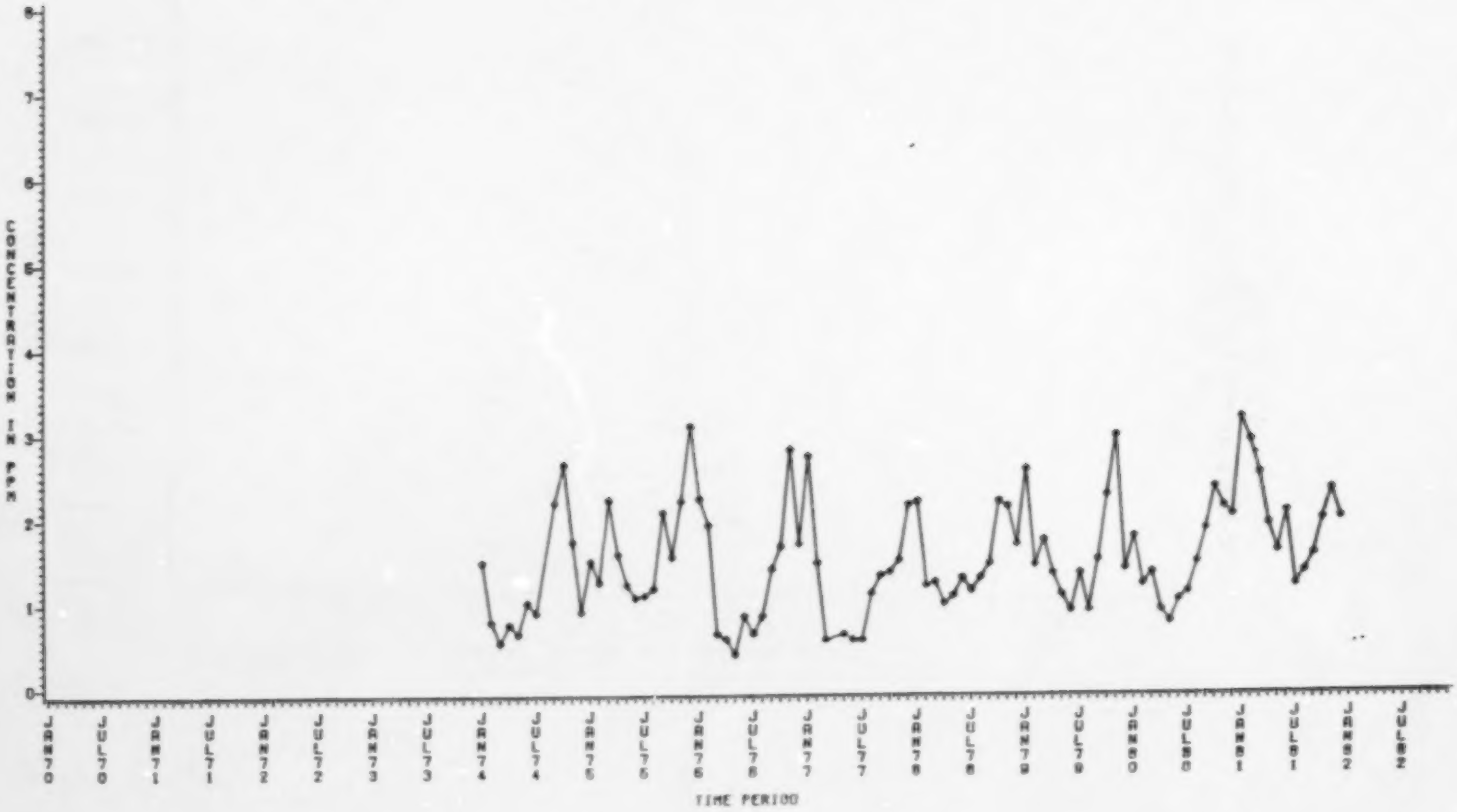
VANCOUVER

COMPOSITE MONTHLY MEAN CO CONCENTRATIONS FOR RESIDENTIAL STATIONS



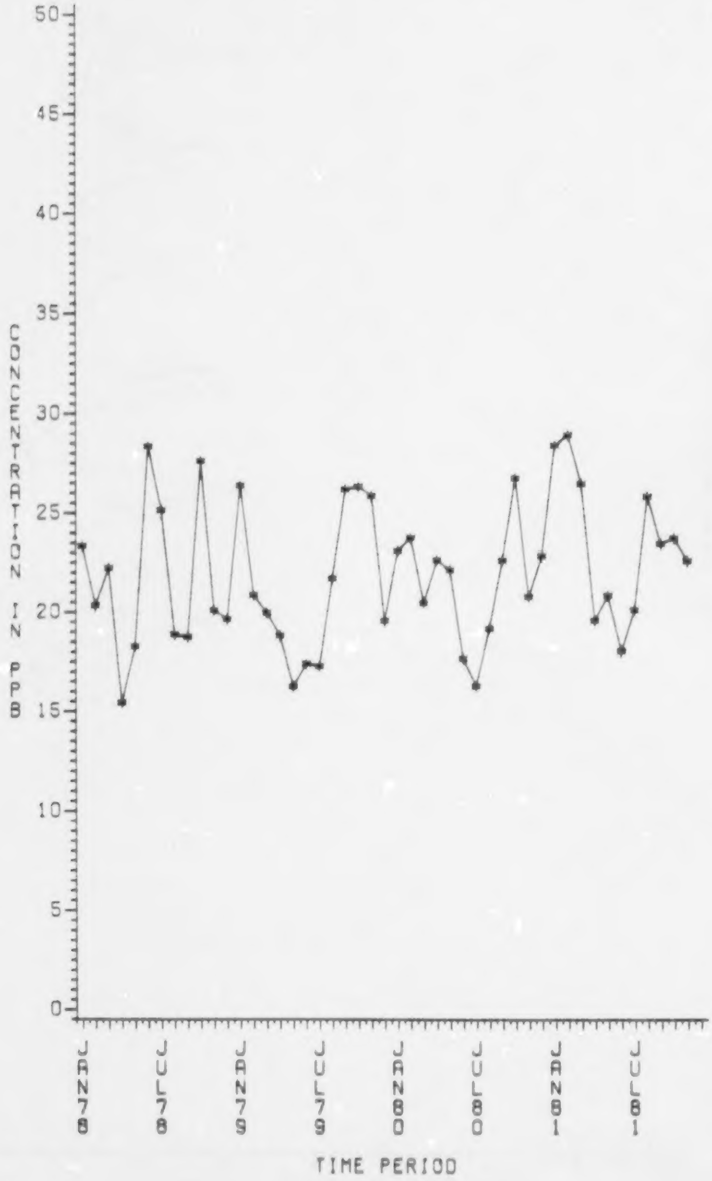
VANCOUVER

COMPOSITE MONTHLY MEAN CO CONCENTRATIONS
FOR NON-RESIDENTIAL STATIONS



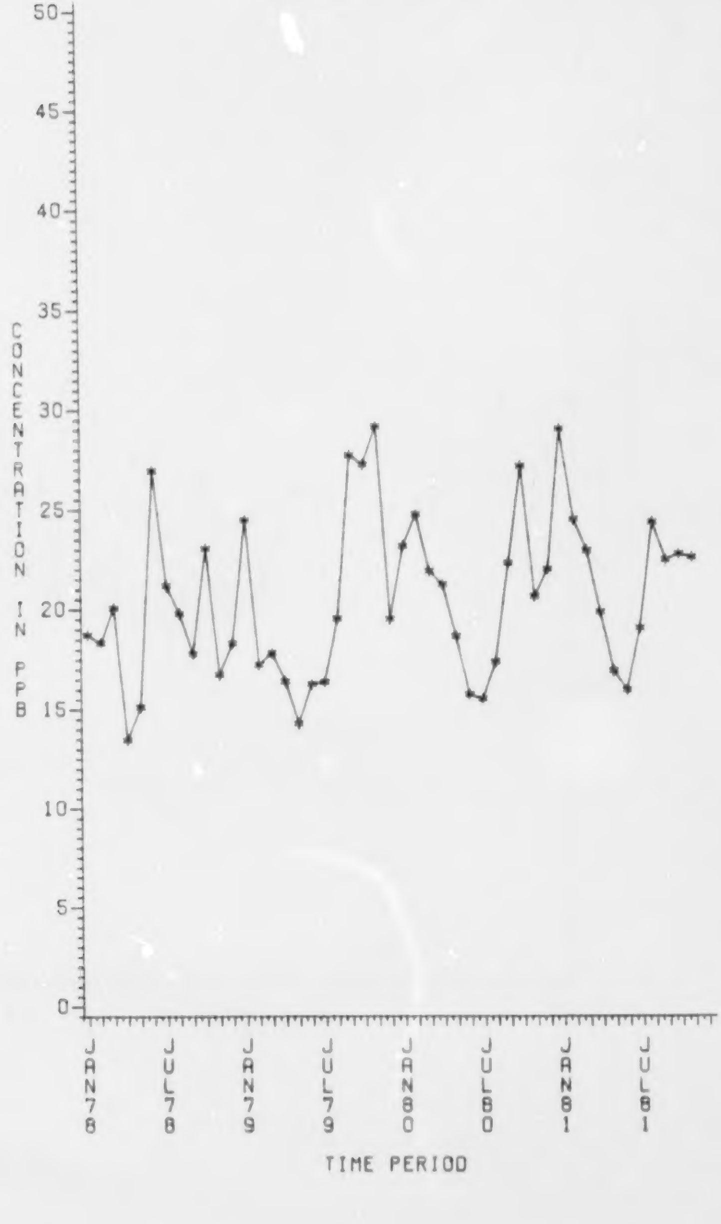
VANCOUVER

COMPOSITE MONTHLY MEAN NO2 CONCENTRATIONS FOR ALL STATIONS



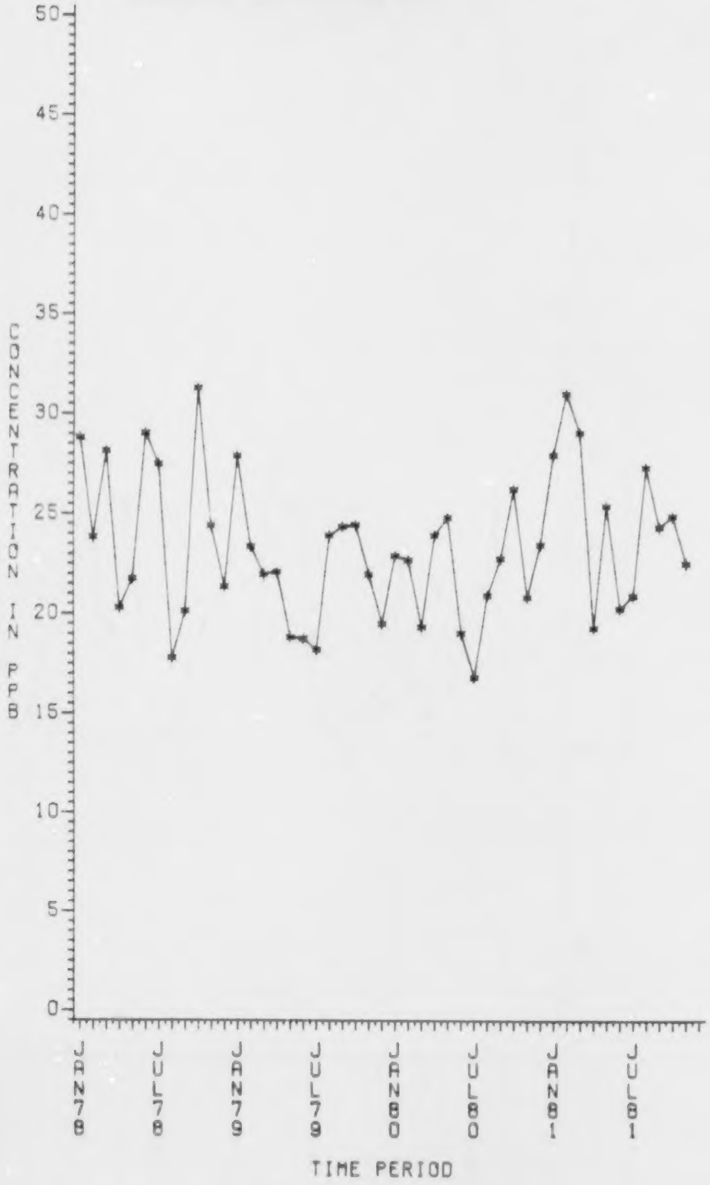
VANCOUVER

COMPOSITE MONTHLY MEAN NO2 CONCENTRATIONS FOR RESIDENTIAL STATIONS



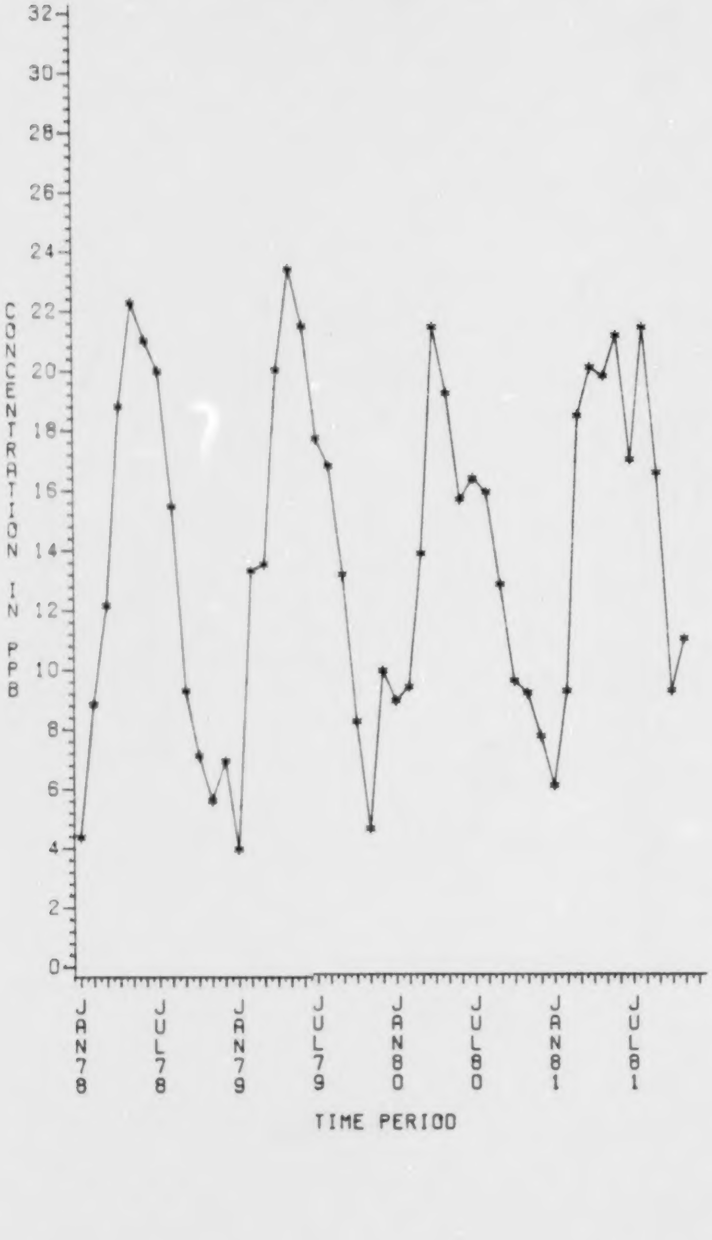
VANCOUVER

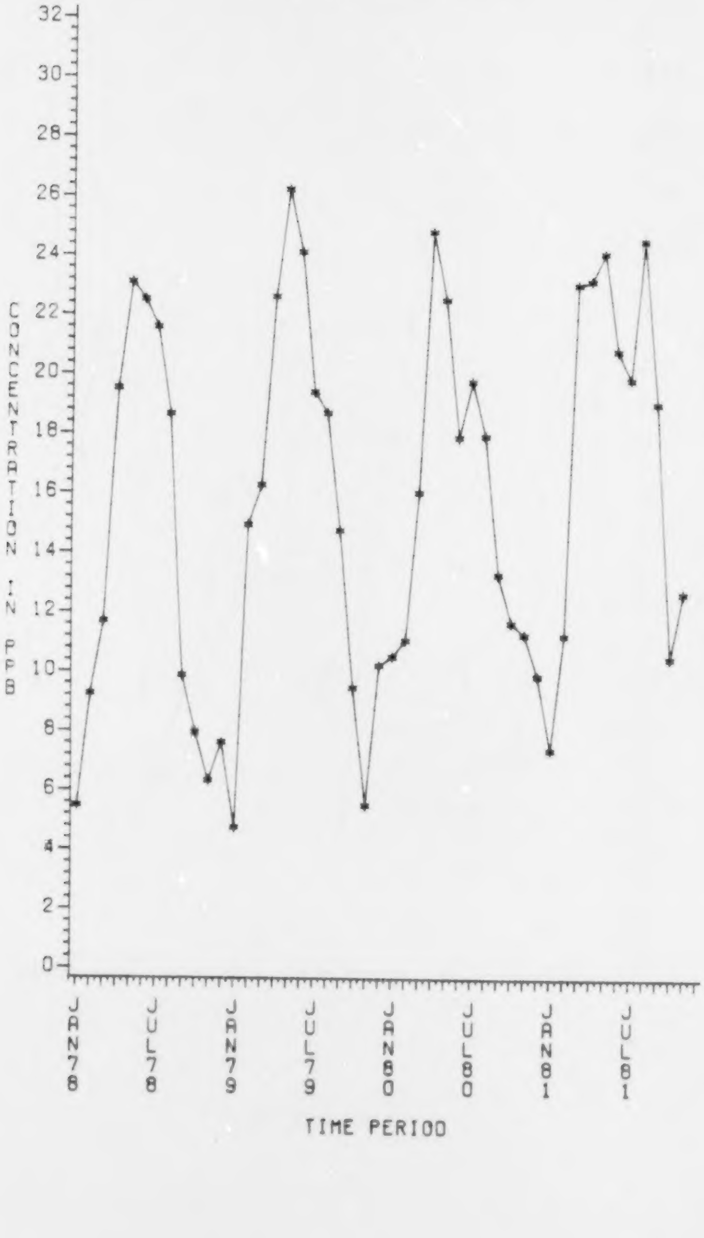
COMPOSITE MONTHLY MEAN NO2 CONCENTRATIONS FOR NON-RESIDENTIAL STATIONS



VANCOUVER

COMPOSITE MONTHLY MEAN OZONE CONCENTRATIONS FOR ALL STATIONS



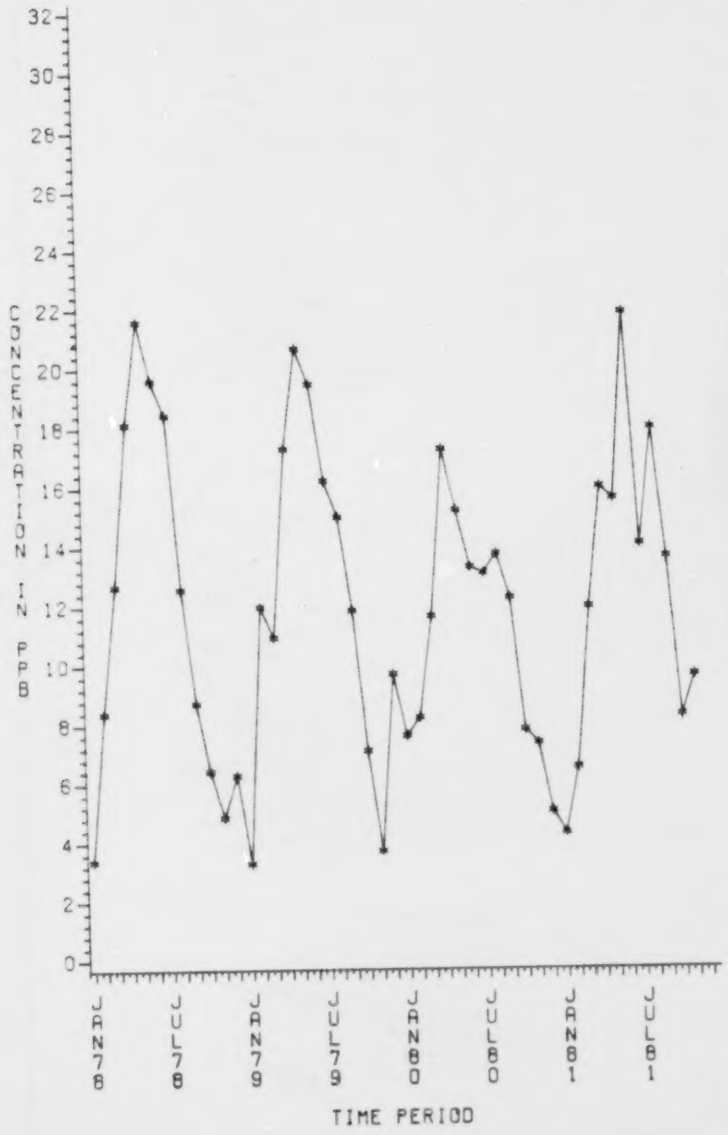


VANCOUVER

COMPOSITE MONTHLY MEAN OZONE CONCENTRATIONS FOR RESIDENTIAL STATIONS

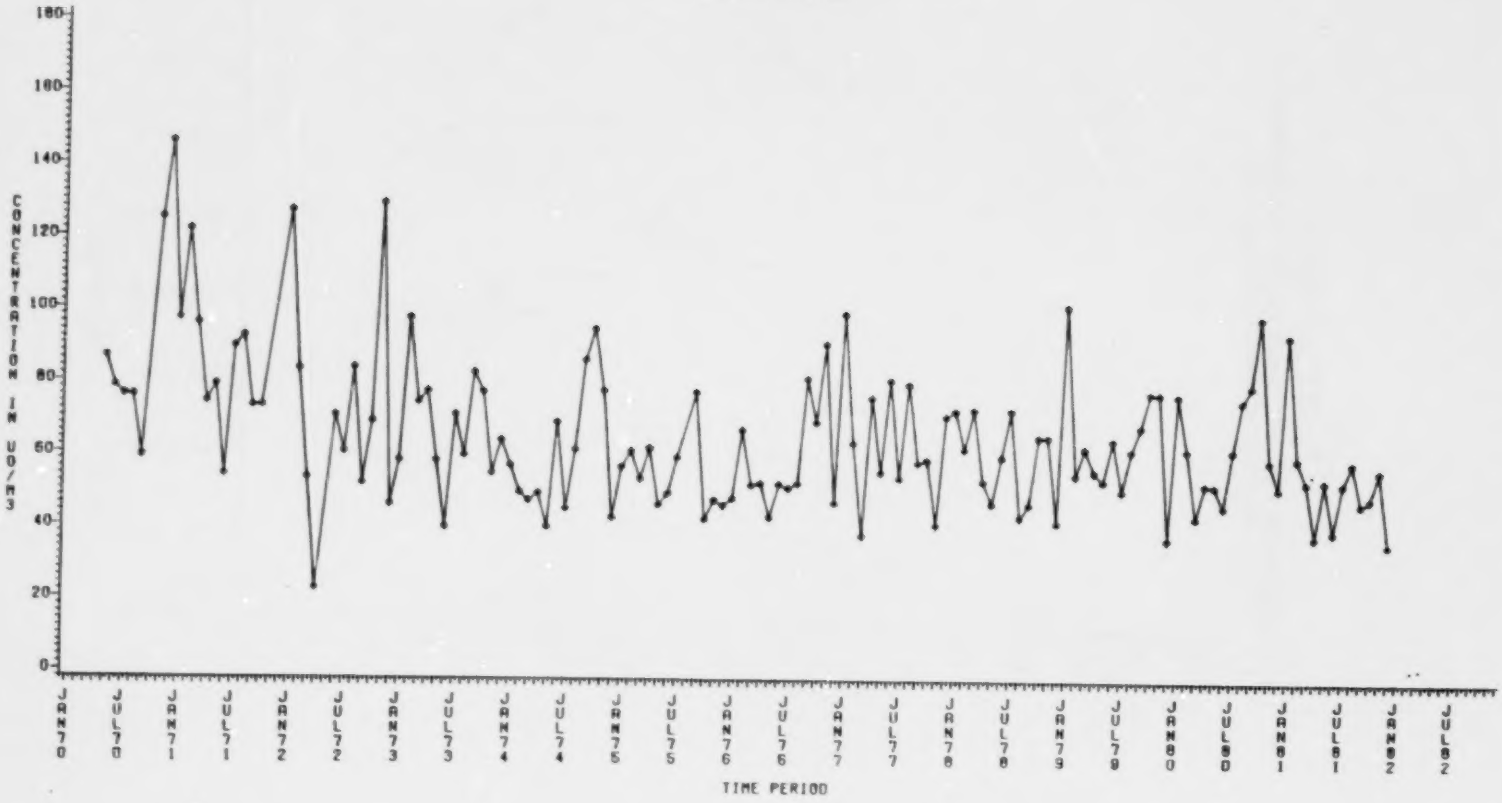
VANCOUVER

COMPOSITE MONTHLY MEAN OZONE CONCENTRATIONS FOR NON-RESIDENTIAL STATIONS



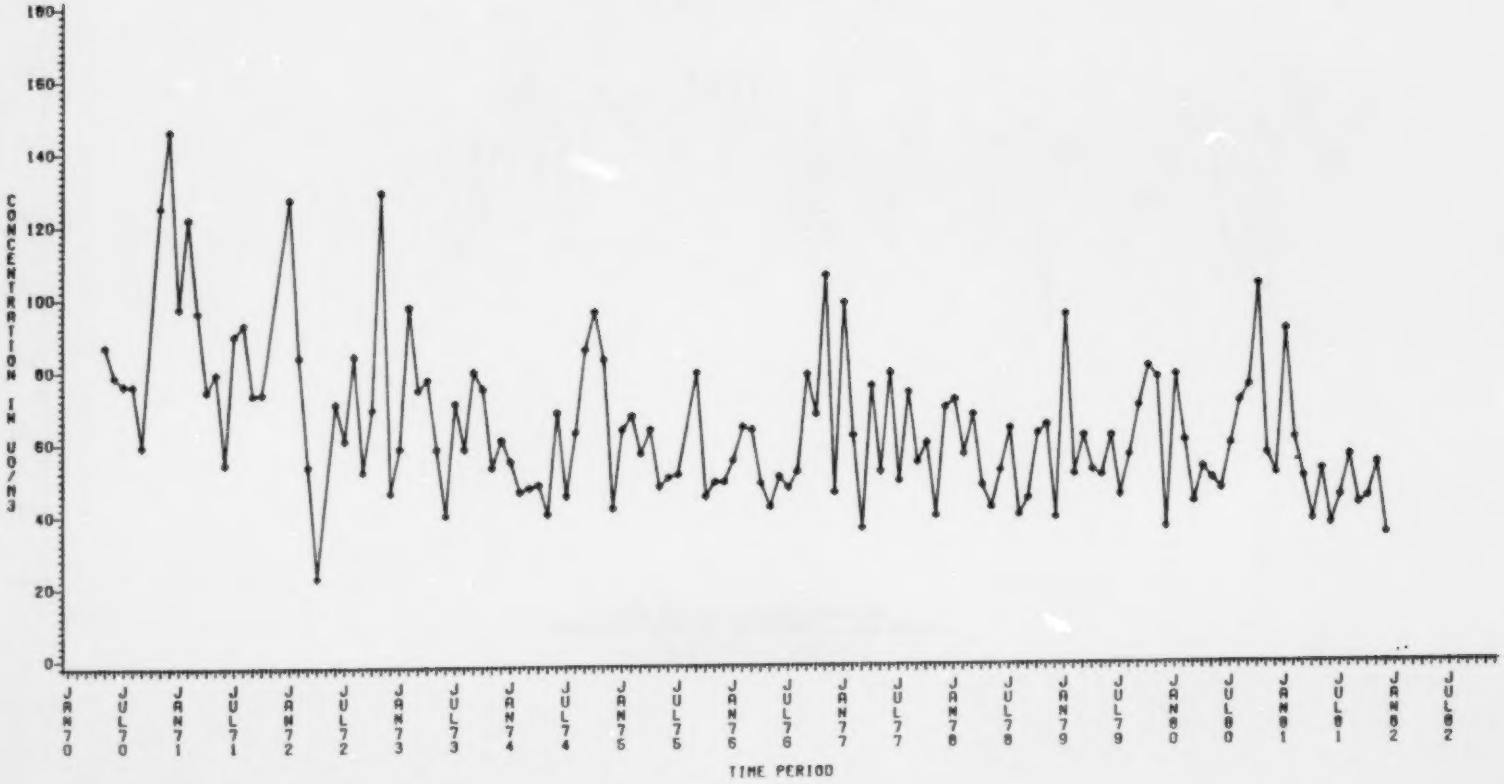
VANCOUVER

COMPOSITE MONTHLY MEAN TSP CONCENTRATIONS FOR ALL STATIONS



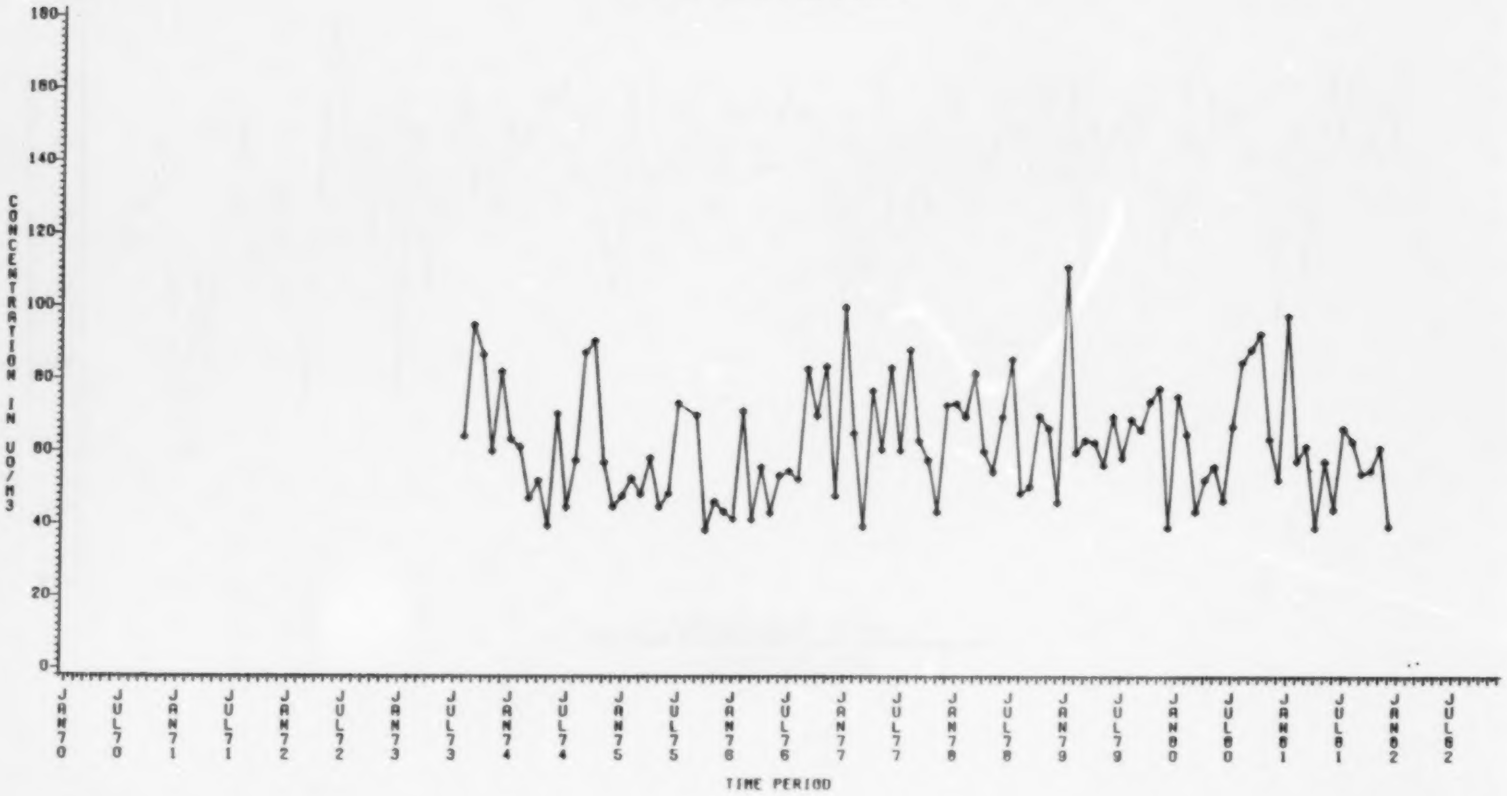
VANCOUVER

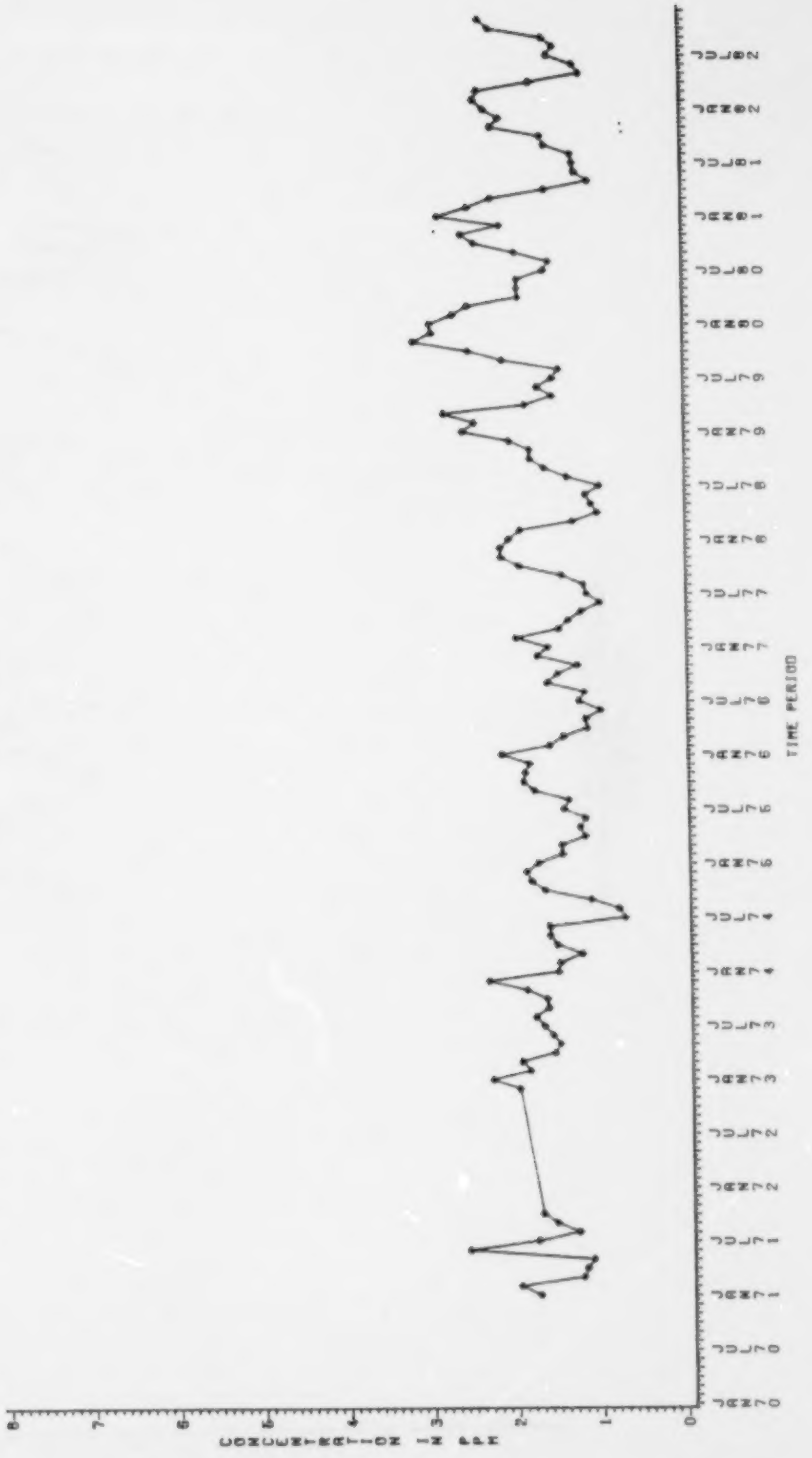
COMPOSITE MONTHLY MEAN TSP CONCENTRATIONS FOR RESIDENTIAL STATIONS



VANCOUVER

COMPOSITE MONTHLY MEAN TSP CONCENTRATIONS FOR NON-RESIDENTIAL STATIONS

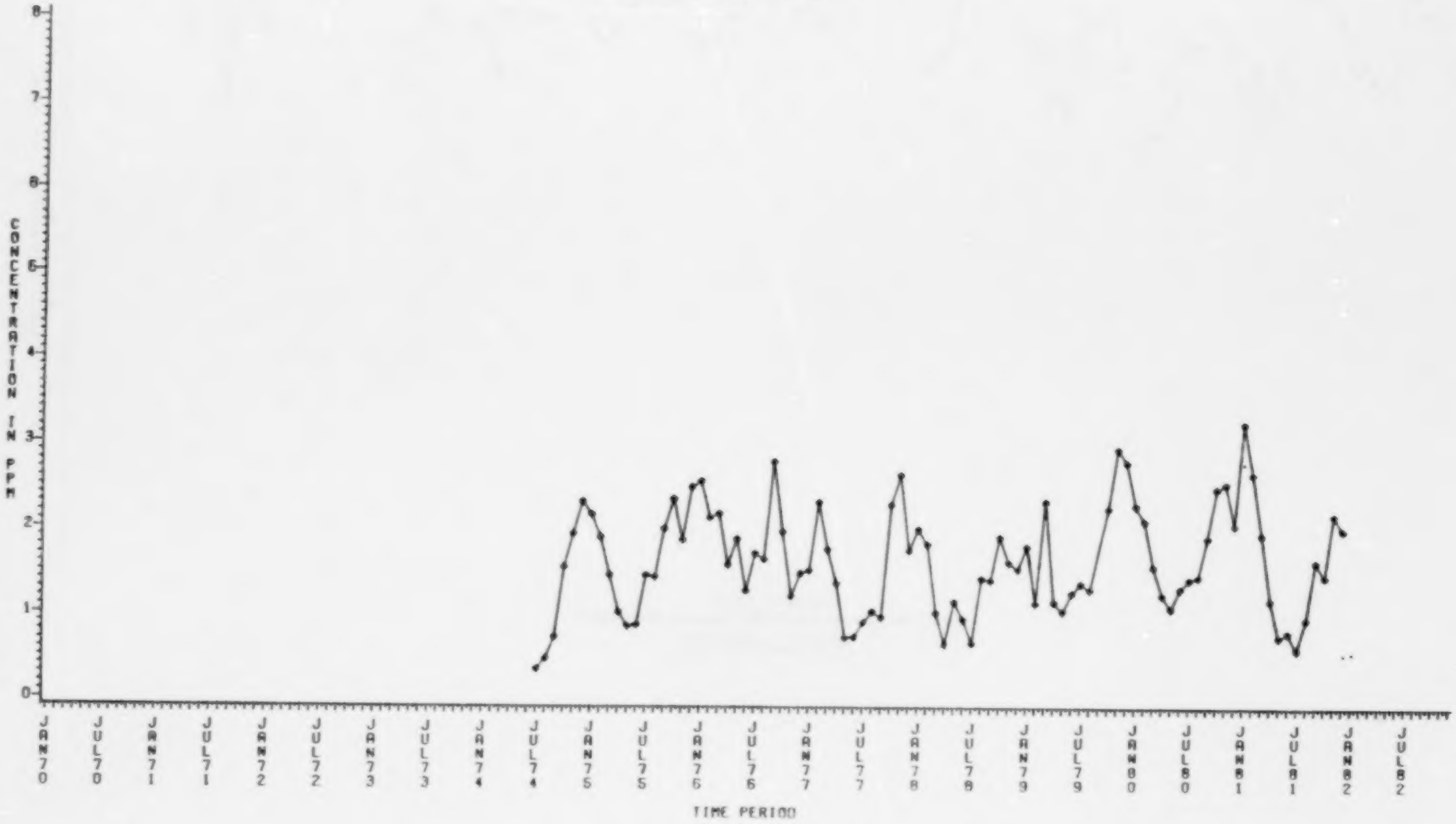




EDMONTON
COMPOSITE MONTHLY MEAN CO CONCENTRATIONS
FOR ALL STATIONS

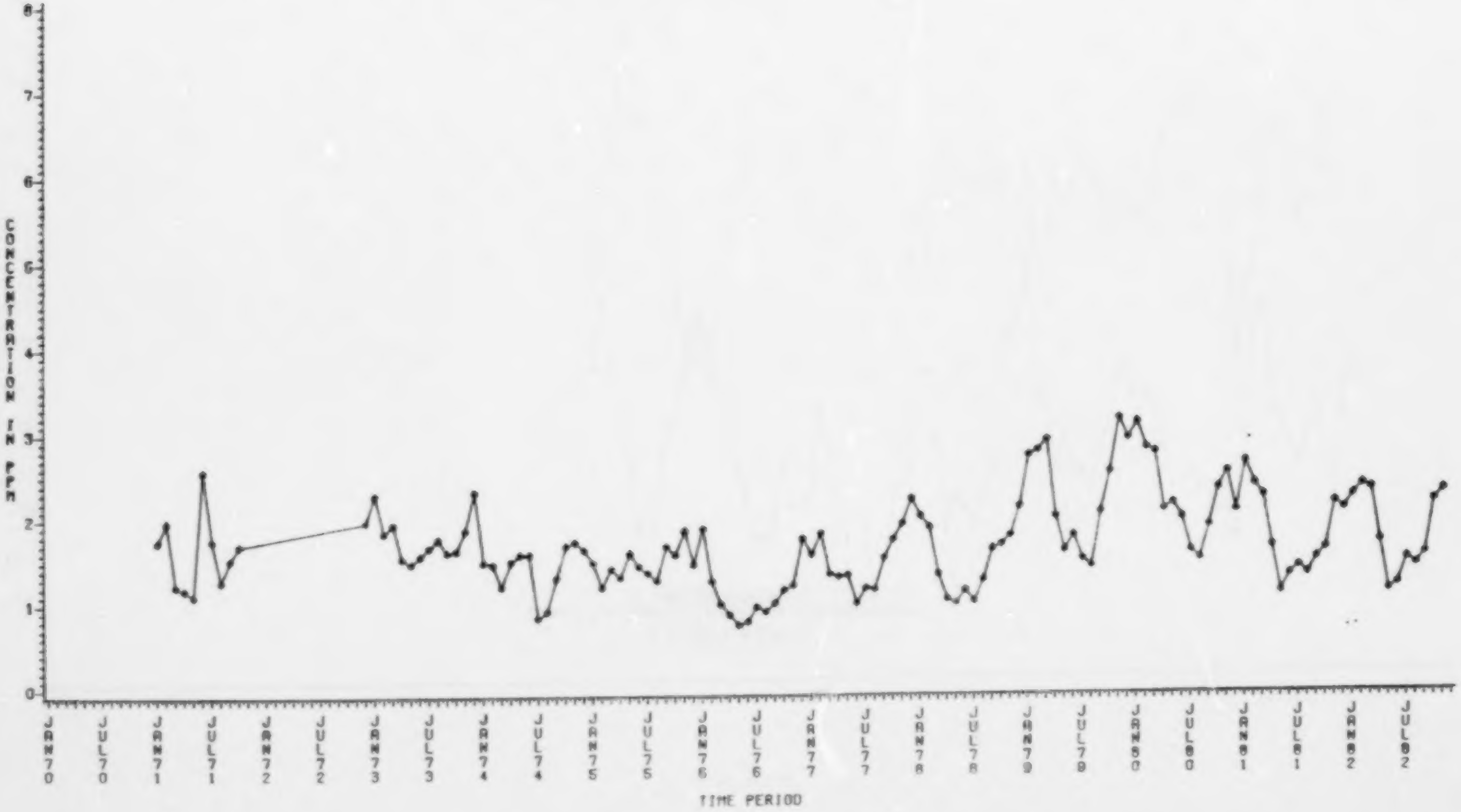
EDMONTON

COMPOSITE MONTHLY MEAN CO CONCENTRATIONS FOR RESIDENTIAL STATIONS



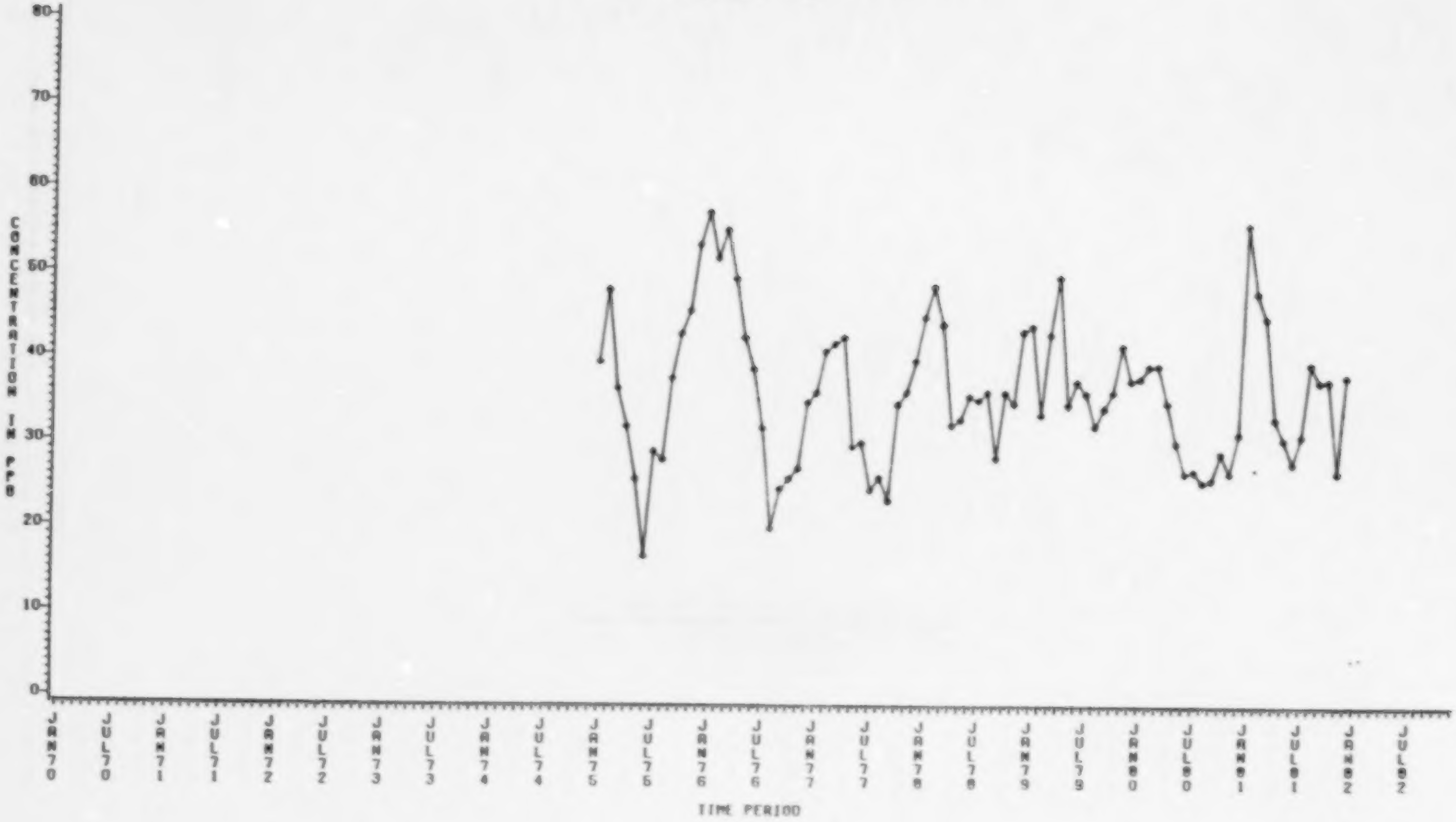
EDMONTON

COMPOSITE MONTHLY MEAN CO CONCENTRATIONS
FOR NON-RESIDENTIAL STATIONS



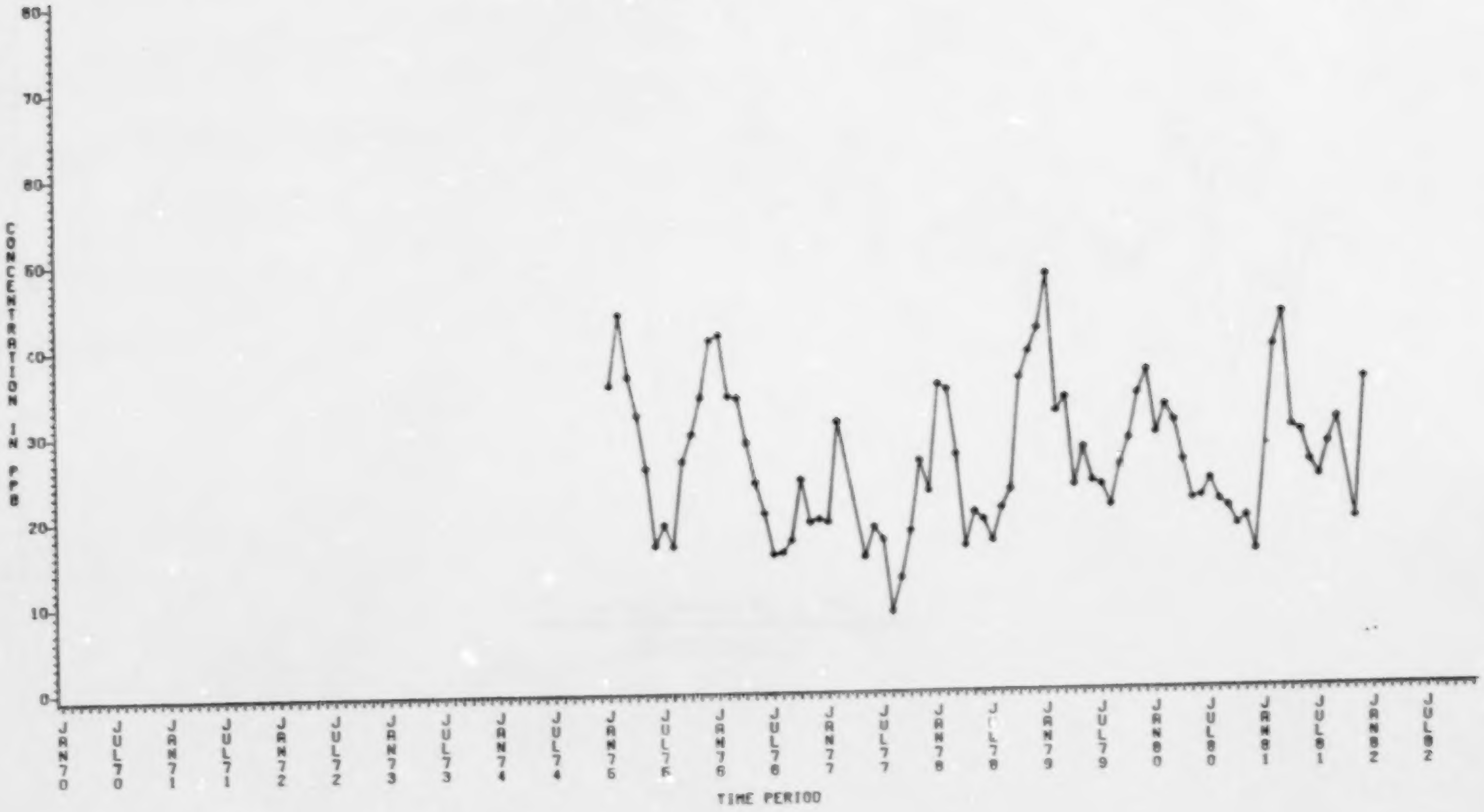
EDMONTON

COMPOSITE MONTHLY MEAN NO2 CONCENTRATIONS
FOR ALL STATIONS



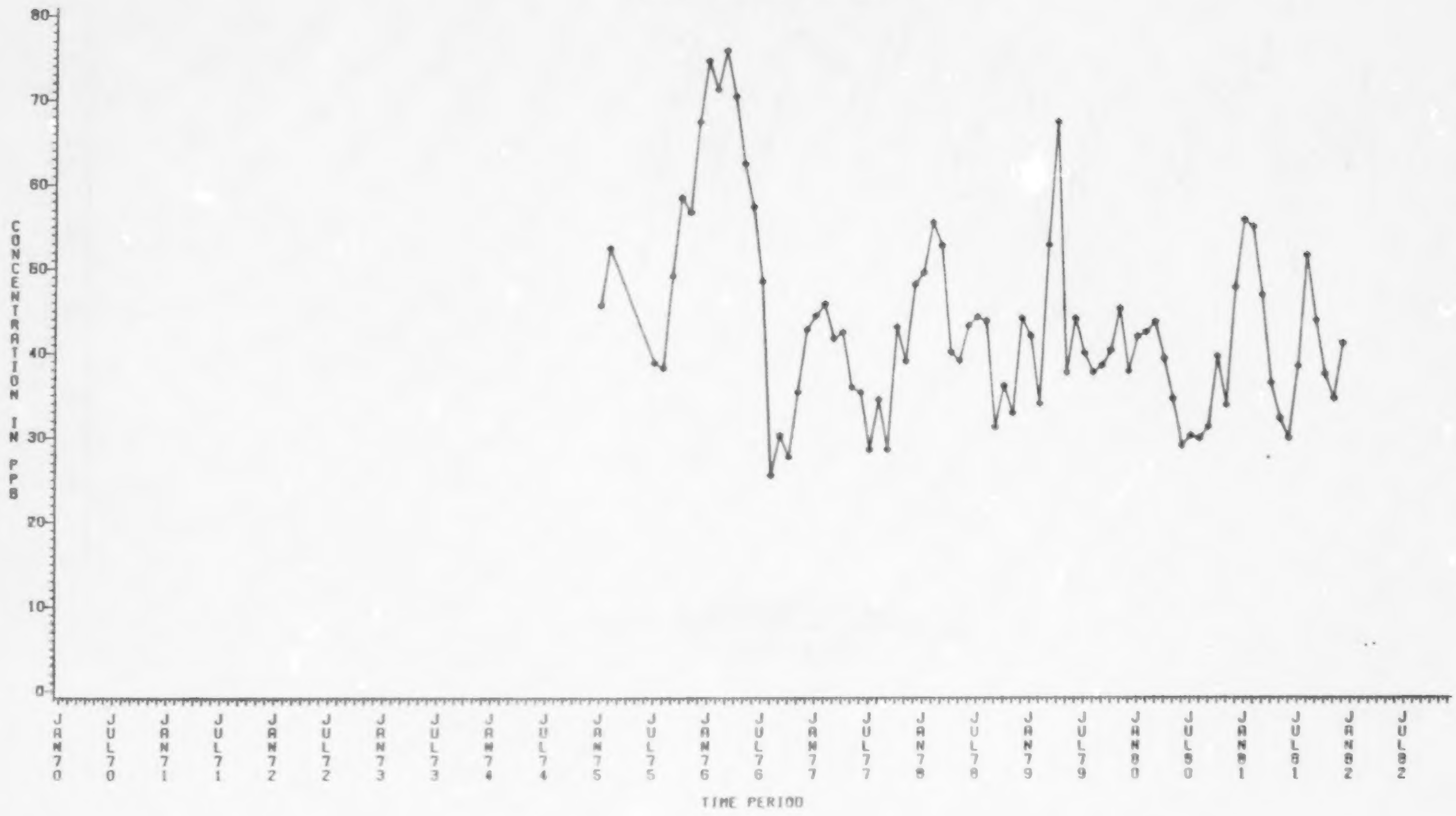
EDMONTON

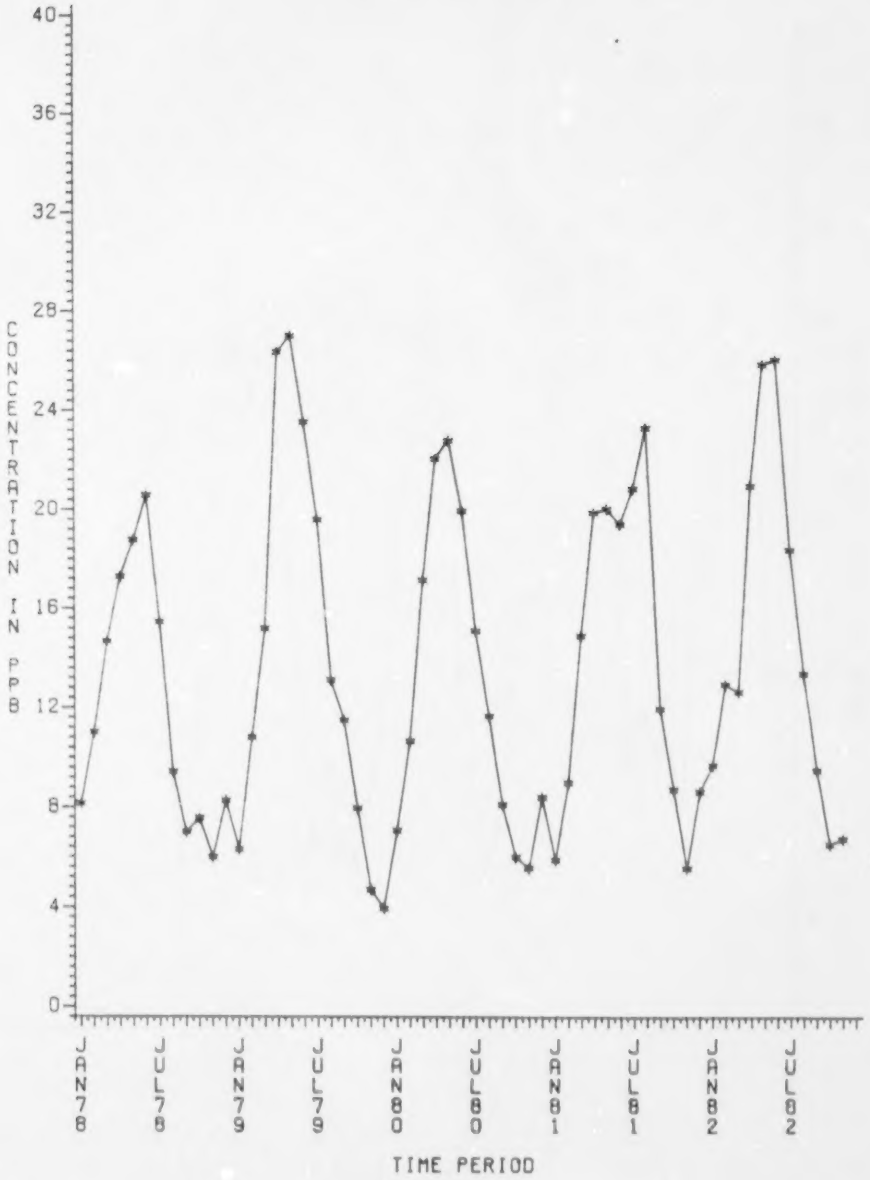
COMPOSITE MONTHLY MEAN NO2 CONCENTRATIONS
FOR RESIDENTIAL STATIONS



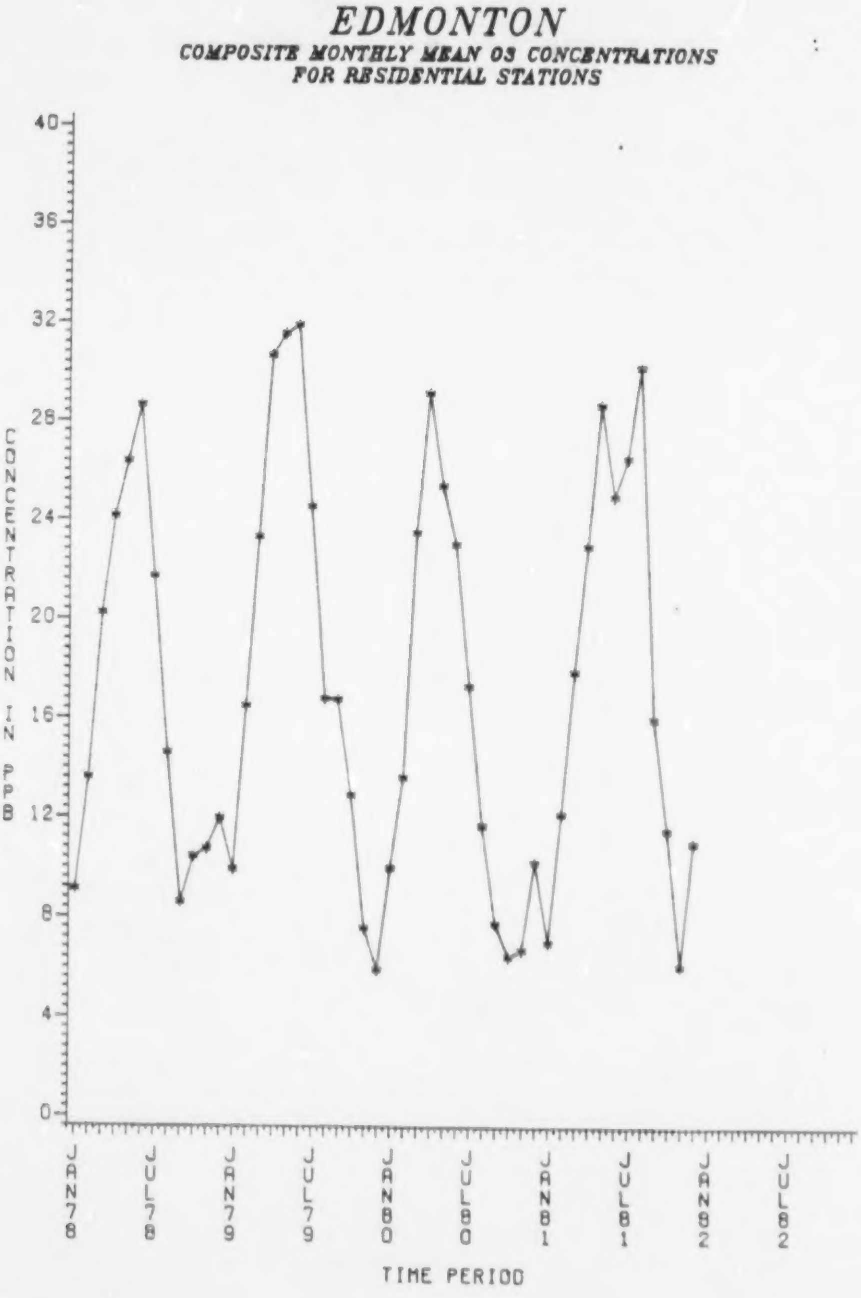
EDMONTON

COMPOSITE MONTHLY MEAN NO2 CONCENTRATIONS
FOR NON-RESIDENTIAL STATIONS



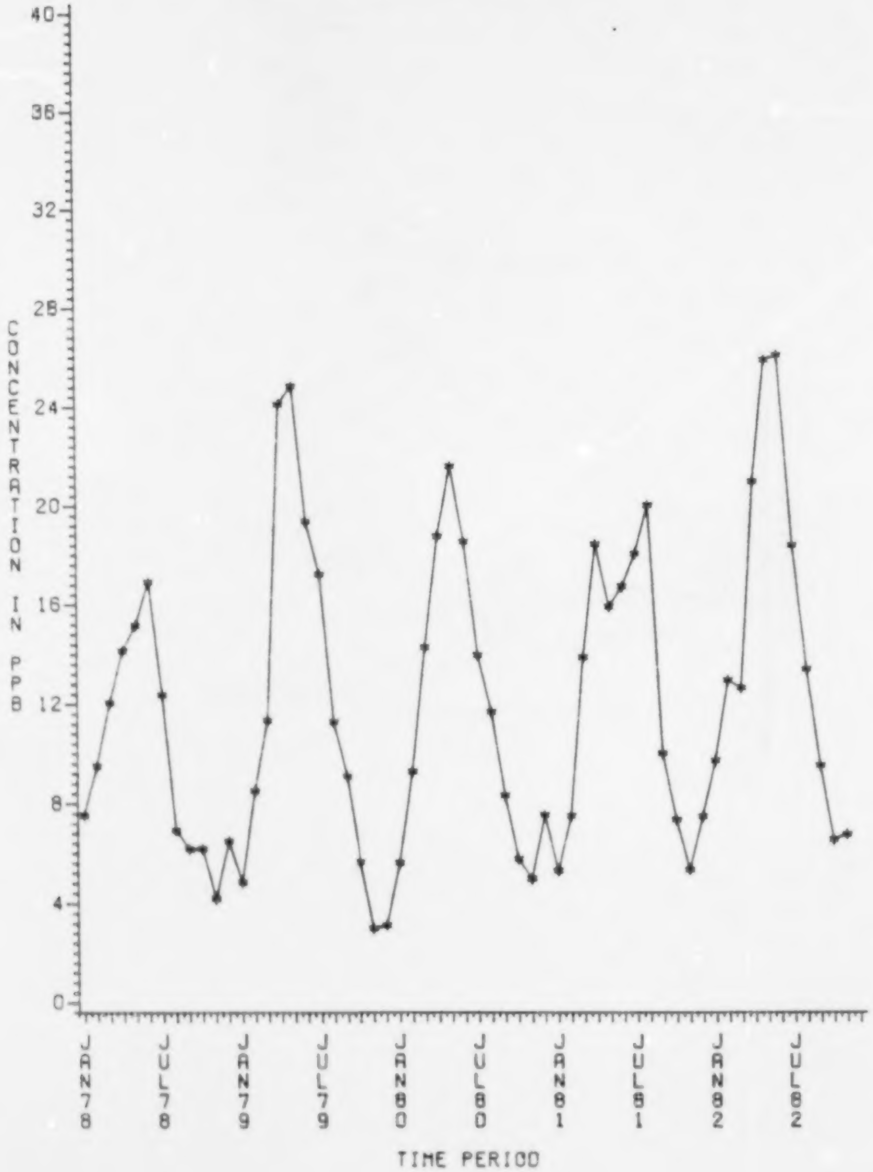


EDMONTON
COMPOSITE MONTHLY MEAN O3 CONCENTRATIONS
FOR ALL STATIONS


EDMONTON
COMPOSITE MONTHLY MEAN O3 CONCENTRATIONS
FOR RESIDENTIAL STATIONS
CONCENTRATION IN PPB
0
4
8
12
16
20
24
28
32
36
40
JAN78
JUL78
JAN79
JUL79
JAN80
JUL80
JAN81
JUL81
JAN82
JUL82
TIME PERIOD

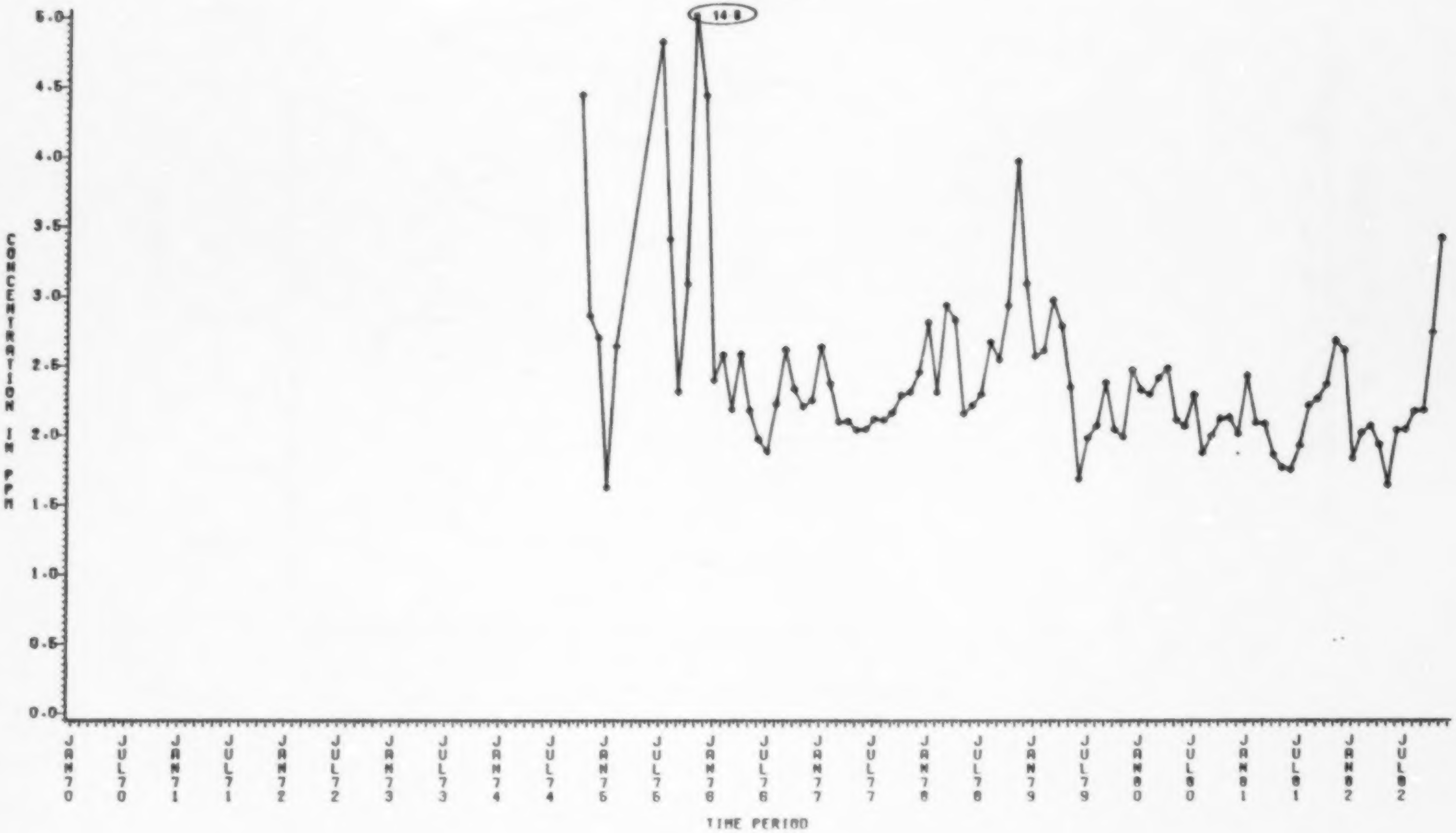
EDMONTON

COMPOSITE MONTHLY MEAN O3 CONCENTRATIONS FOR NON-RESIDENTIAL STATIONS



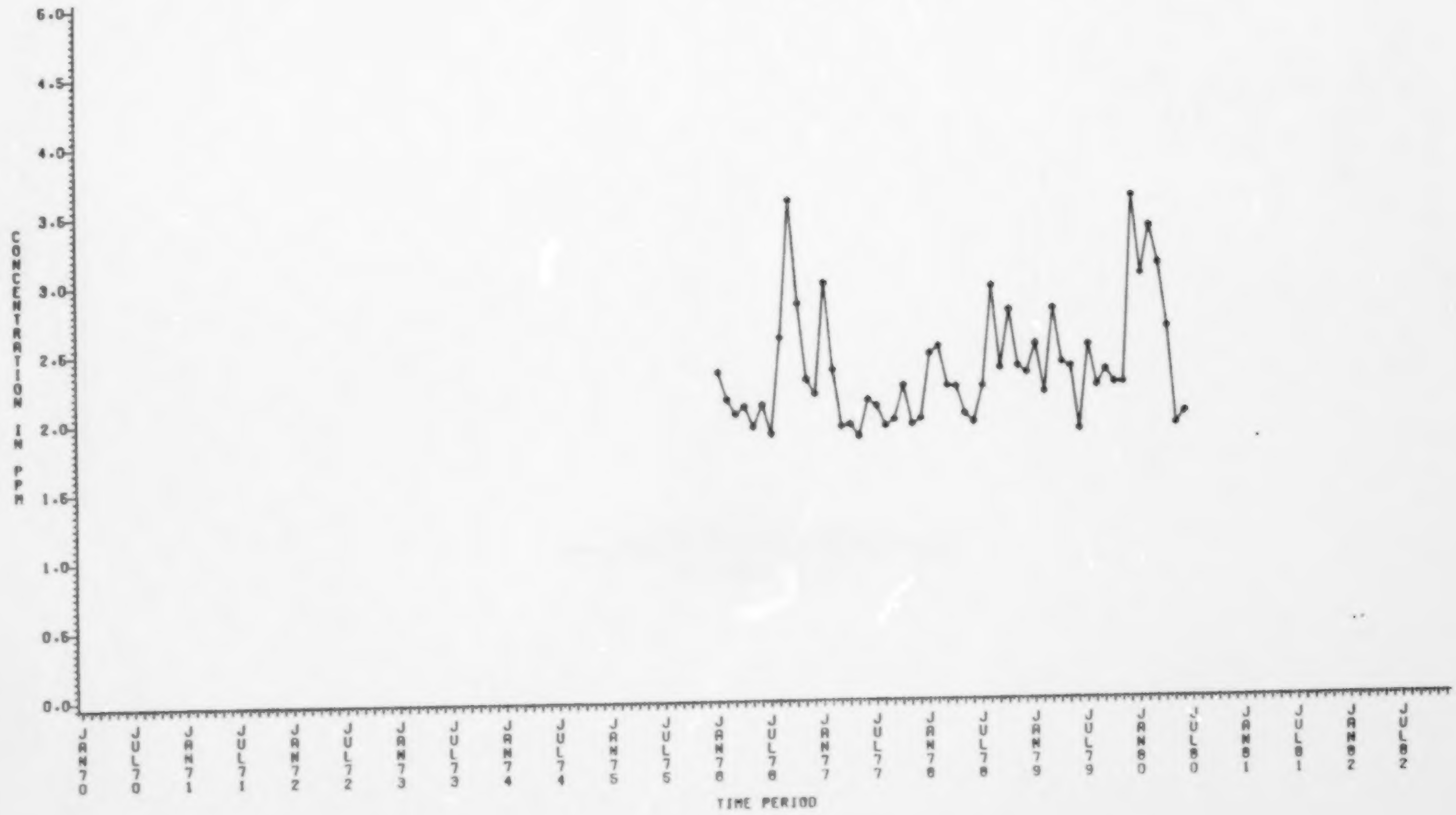
EDMONTON

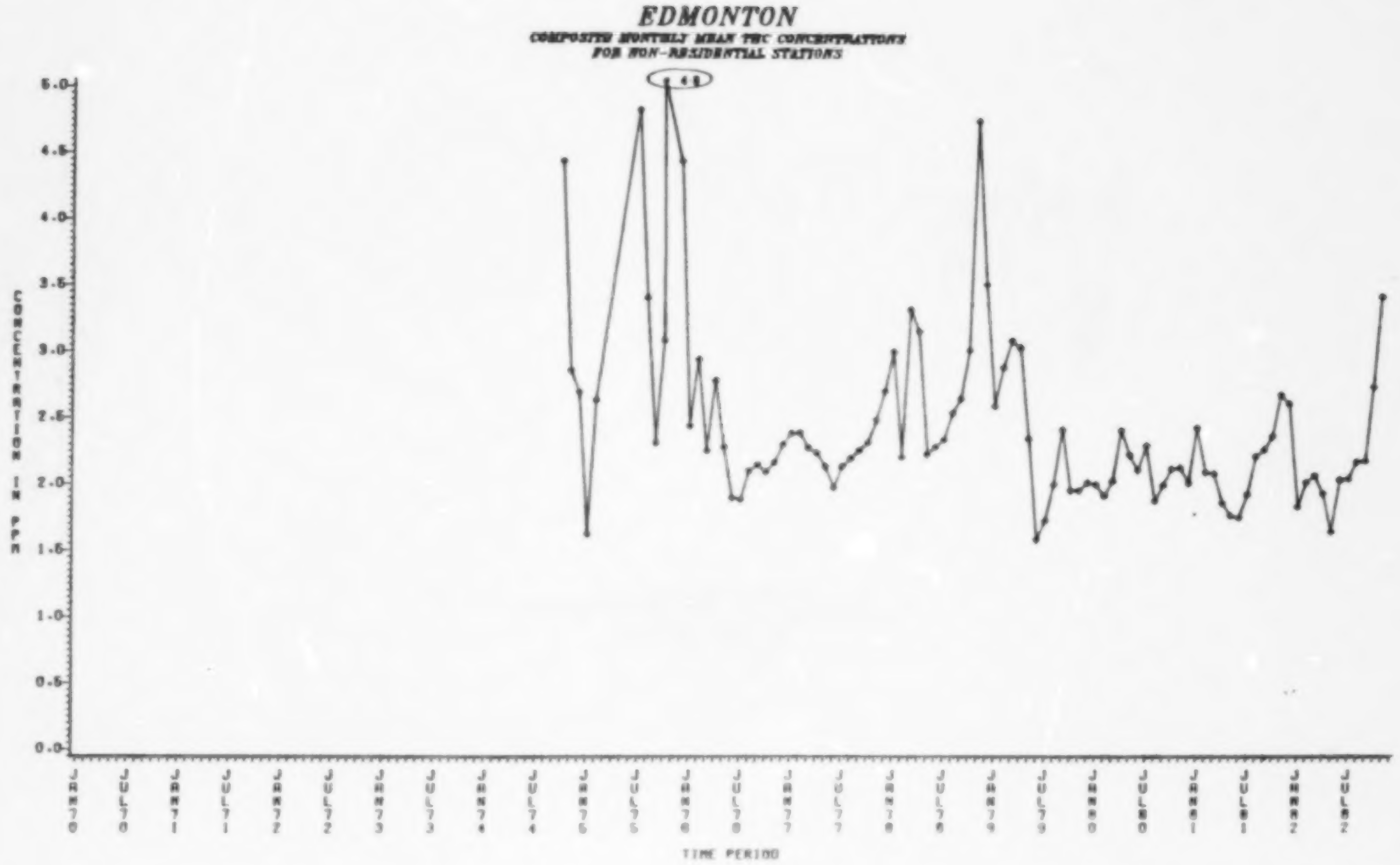
COMPOSITE MONTHLY MEAN THC CONCENTRATIONS
FOR ALL STATIONS



EDMONTON

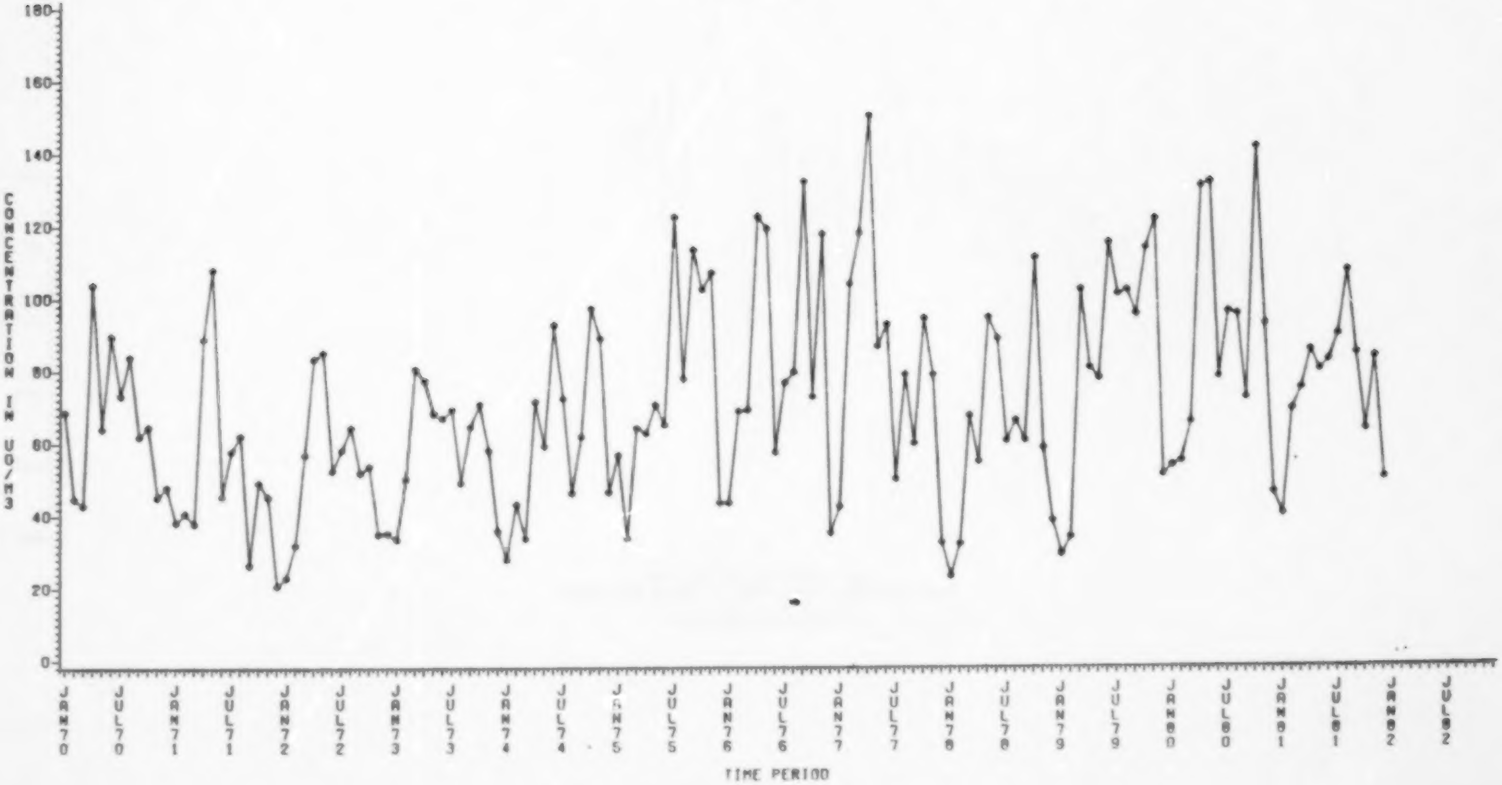
COMPOSITE MONTHLY MEAN THC CONCENTRATIONS
FOR RESIDENTIAL STATIONS




EDMONTON
COMPOSITE MONTHLY MEAN THC CONCENTRATIONS
FOR NON-RESIDENTIAL STATIONS
4 8
CONCENTRATION IN PPM
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
JAN70
JUL70
JAN71
JUL71
JAN72
JUL72
JAN73
JUL73
JAN74
JUL74
JAN75
JUL75
JAN76
JUL76
JAN77
JUL77
JAN78
JUL78
JAN79
JUL79
JAN80
JUL80
JAN81
JUL81
JAN82
JUL82
TIME PERIOD

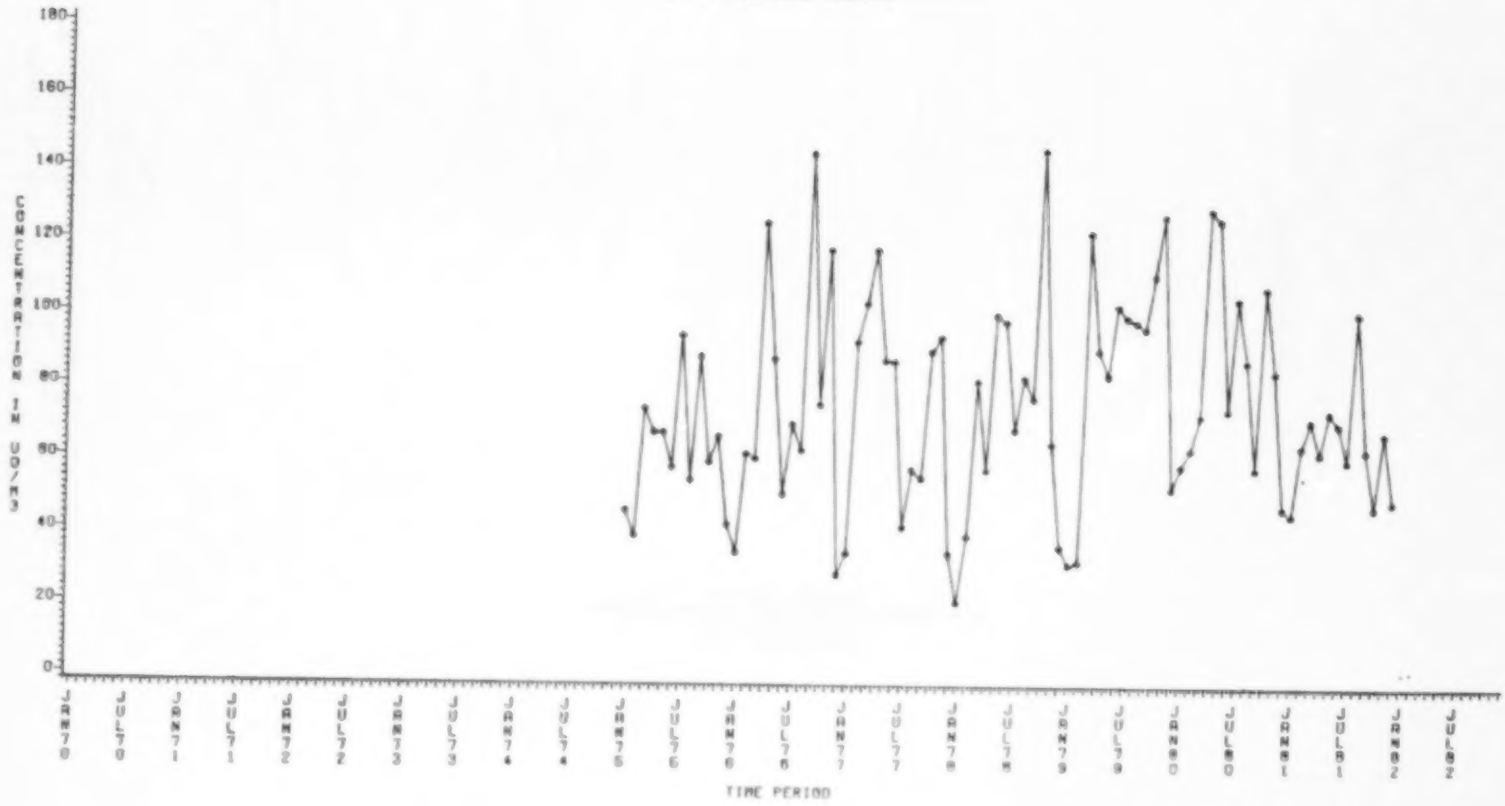
EDMONTON

COMPOSITE MONTHLY MEAN TSP CONCENTRATIONS FOR ALL STATIONS



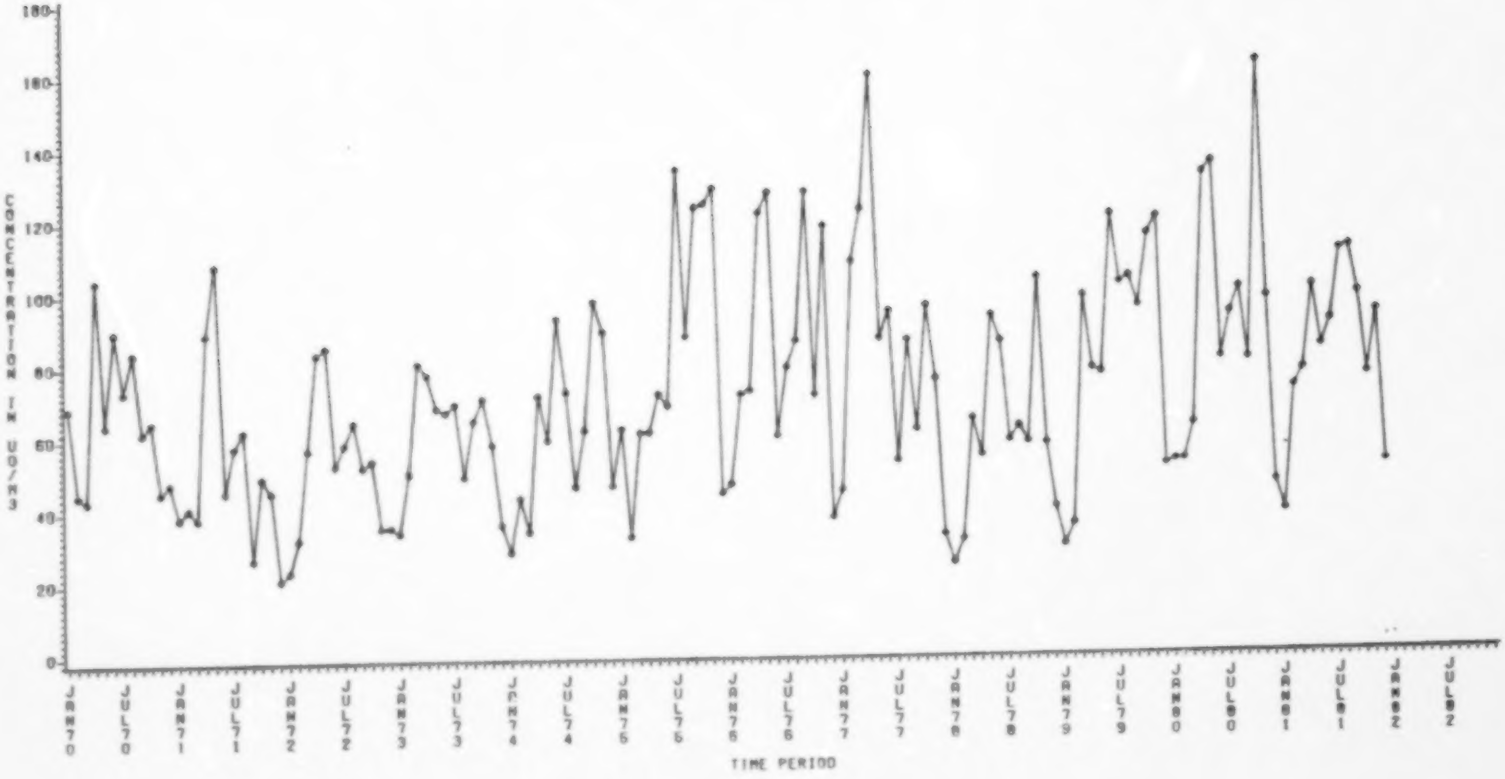
EDMONTON

COMPOSITE MONTHLY MEAN TSP CONCENTRATIONS FOR RESIDENTIAL STATIONS



EDMONTON

COMPOSITE MONTHLY MEAN TSP CONCENTRATIONS
FOR NON-RESIDENTIAL STATIONS



Summary of methods for calculating means and other statistical parameters.

i) Daily mean d_j for station j

$$d_j = \sum_{i=1}^{n_j} x_i/n_j$$

x_i = observation for i^{th} hour at station j

n_j = number of hourly observations in day at station j.

ii) Monthly mean m_j at station j

$$m_j = \sum_{k=1}^{N} d_{jk} N_{jk} / \sum_{k=1}^{N} N_{jk}$$

N = Number of days in month

$$N_j = \sum_{k=1}^{N} N_{jk}$$

N_j = Number of hourly observations in month with N days at station j.

iii) Composite monthly mean M_m for any group of J stations in M^{th} Month.

$$M_m = \sum_{j=1}^{J} M_j N_j / \sum N_j$$

J = Total number of stations.

iv) Composite annual mean

$$A = \sum_{M=1}^{12} \left(\sum_{j=1}^{J} m_{jm} N_{jm} / \sum_{j=1}^{J} N_{jm} \right)$$

Environment Canada Environnement Canada

2028105F

C3JF

POOR

QUALITY

ORIGINAL